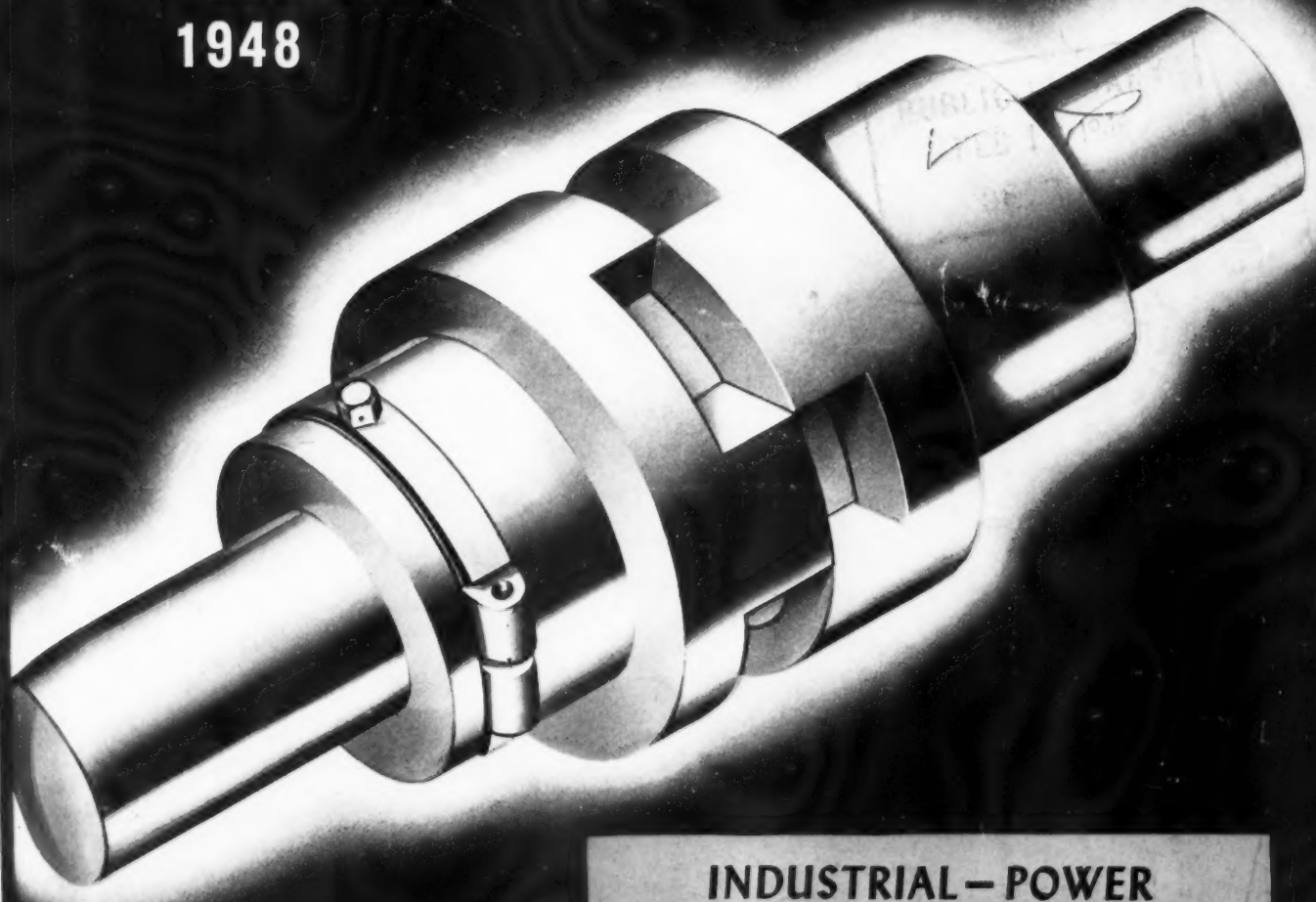
POWER

A McGRAW-HILL PUBLICATION DEVOTED TO GENERATION, TRANSMISSION AND APPLICATION OF ALL THE POWER SERVICES

FEBRUARY
1948



INDUSTRIAL—POWER

CLUTCHES

A special section, pages 79-94

TABLE OF CONTENTS, *page 59*

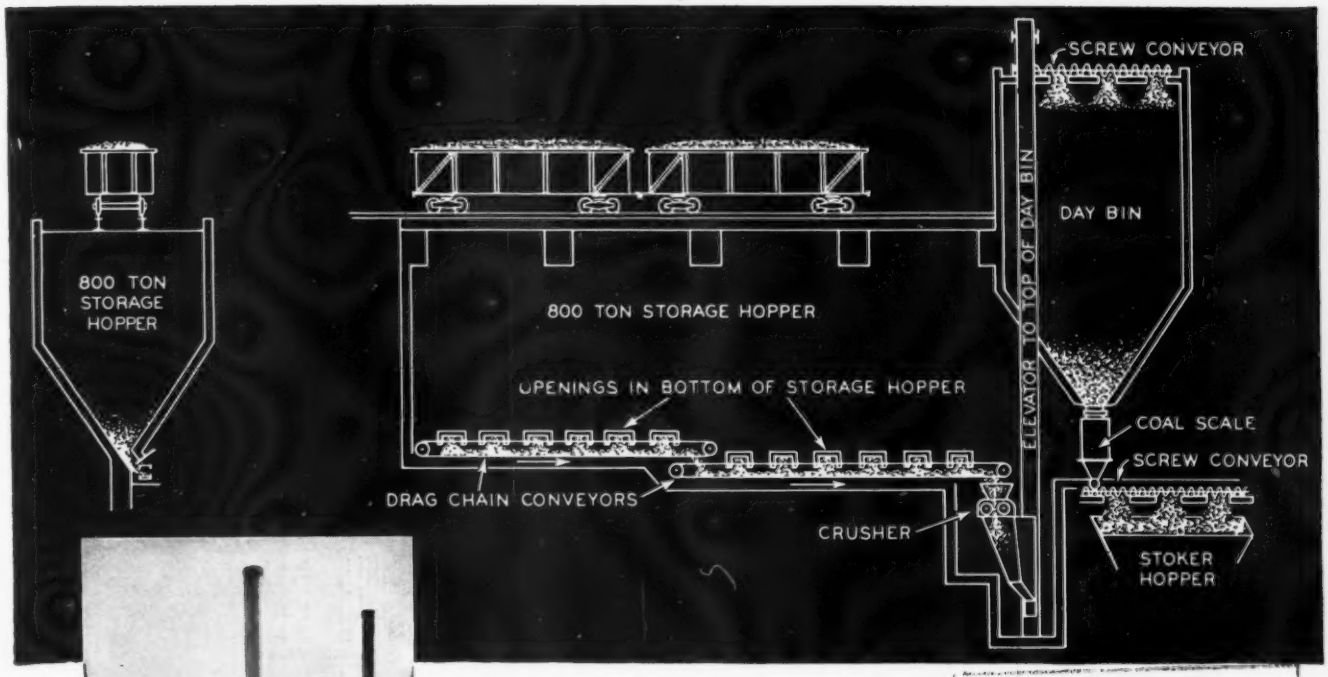
Scores greatest triumph—*in a selected field*—on a hard going, heavy course.

We picked the cream of abrasion resistant alloys—made discs of them—*carefully weighed them*—keyed them on a shaft—*churned them thru a mixture of sharp sand, emery, metal filings and other slurries for hours*—removed them —*carefully weighed them again*—calculated the loss due to abrasive action.

We knew Ashcolite would win, but not by such a wide margin. A large chemical company learned this the hard way; they tried them all. You can benefit the easy way.

When abrasion is the problem—Ashcolite is the metal. We make Ashcolite Pipe, Ashcolite fittings and use Ashcolite in Hydroseal Materials Handling Pumps, etc., etc.
The Allen-Sherman-Hoff Co., 227 S. 15th St., Phila. 2, Pa.

...ER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," "The Stationary Engineer"), February, 1948, Vol. 92, ... Published monthly with an additional Directory in December, McGraw-Hill Publishing Company, Inc. Publication office, 99-129 N. Broadway, Albany 1, ...litorial and executive offices, 330 W. 42nd St., New York 18, N. Y. Entered as second class matter August 25, 1936, at Albany, N. Y., under the act of ..., 1879. Printed in U. S. A. Allow at least 10 days for change of address. All communications about subscriptions should be addressed to the Director of ..., Power, 330 W. 42nd St., New York 19, N. Y. subscription rates, U. S. and U. S. possessions, $5 for one year, $8 for two years. 50c per single copy. ... for one year, $9 for two years. Pan American countries, $10 for one year, $16 for two years. All other countries $15 for one year, $25 for two years. ...cate position and company connection on all subscription orders.



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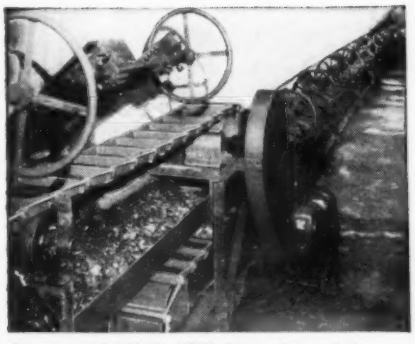
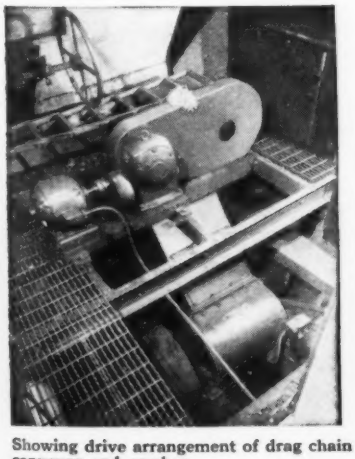
DETROIT

Central States Electric utilizes topography in Coal Handling



Showing Link-Belt "H" Class drag chain conveyors which take coal from bottom of track storage hopper to crusher.



Showing drive arrangement of drag chain conveyor and crusher.

This unusual layout again demonstrates the ability of Link-Belt to engineer and apply equipment to specific conditions for high efficiency and low handling cost.

The hilly nature of the topography was utilized in laying out the coal handling system for Central States Electric Company, Iowa Falls, Iowa. Coal is received at a higher level than the boilers, and goes into a storage hopper holding 800 tons.

A Link-Belt drag chain conveyor takes the coal from the hopper bottom to a crusher, then to a day bin holding 80 tons. From this bin the coal is delivered by screw conveyor through automatic weighing devices to the stoker-spreader conveyor. The stoker has speed regulation in response to load variation, operating through Link-Belt P.I.V. Gear.

The engineering department of Central States Electric Company cooperated with Link-Belt engineers in the development of this layout.

Let us consult with you on your coal and ashes handling layout and equipment problems.

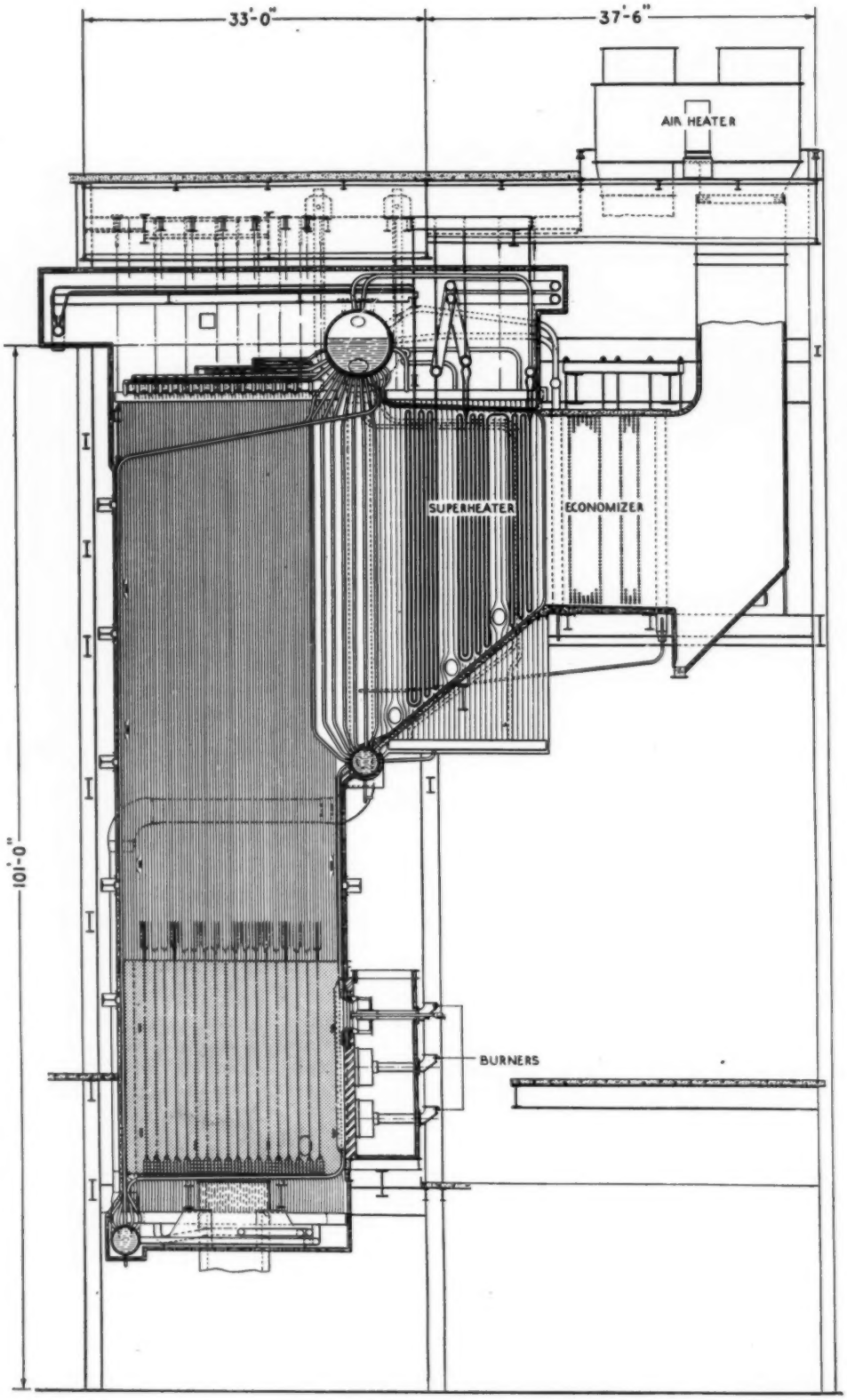
LINK-BELT COMPANY

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices in Principal Cities. 10,791

LINK BELT

THE SYMBOL OF QUALITY — LB — LINK-BELT

COAL AND ASHES HANDLING EQUIPMENT



Radiant Boiler for an Eastern Central Station. Capacity—900,000 Lb. per Hr. at 1500 psi, 975 F.

Significant Statistics

about B&W RADIANT BOILERS

Last year's "Best Seller" among central-station steam-generating units was the B&W Radiant Boiler. Among them was the largest capacity B&W boiler ever designed for central-station service—1,100,000 lb. of steam per hour. Four of the units will deliver steam at pressures over 2000 psi with 1050F at the superheater outlet. Most of the boilers will be fired with pulverized coal—the others will use this fuel and oil and natural gas in combination or oil and gas alone. A predominate feature of this boiler is its ability to perform up to expectations with the widest range in fuel type and quality likely to be experienced in any location.

Introduced only 12 years ago, the B&W Radiant Boiler has amassed this fine record of acceptance:

- Aggregate steam capacity of units now in service and on order is over 60,000,000 lb. per hour.
- Nearly 25 per cent of all units sold to date are repeat orders.
- Installations are spread over 21 states in all sections of the country.

These statistics add up to this significant fact: The Radiant Boiler is admirably matched to modern central-station requirements over the entire range of conditions encountered in this service.

G-384 T

FOR POWER PLANTS — B&W, Open-Pass, Radiant, Integral-Furnace, Cross-Drum, Stirling and Waste-Heat Stationary Boilers . . . Air Heaters . . . Economizers . . . Superheaters . . . Water-Cooled Furnaces . . . Oil, Gas & Multifuel Burners . . . Chain-Grate Stokers . . . Stacks and Breechings . . . Seamless & Welded Tubes for All Pressure and Mechanical Applications . . . Refractories . . . Chemical Recovery Units . . . Alloy Castings.

★ ★ ★

OTHER B&W PRODUCTS — Marine Boilers . . . Pressure Vessels . . . Process Equipment

BABCOCK & WILCOX

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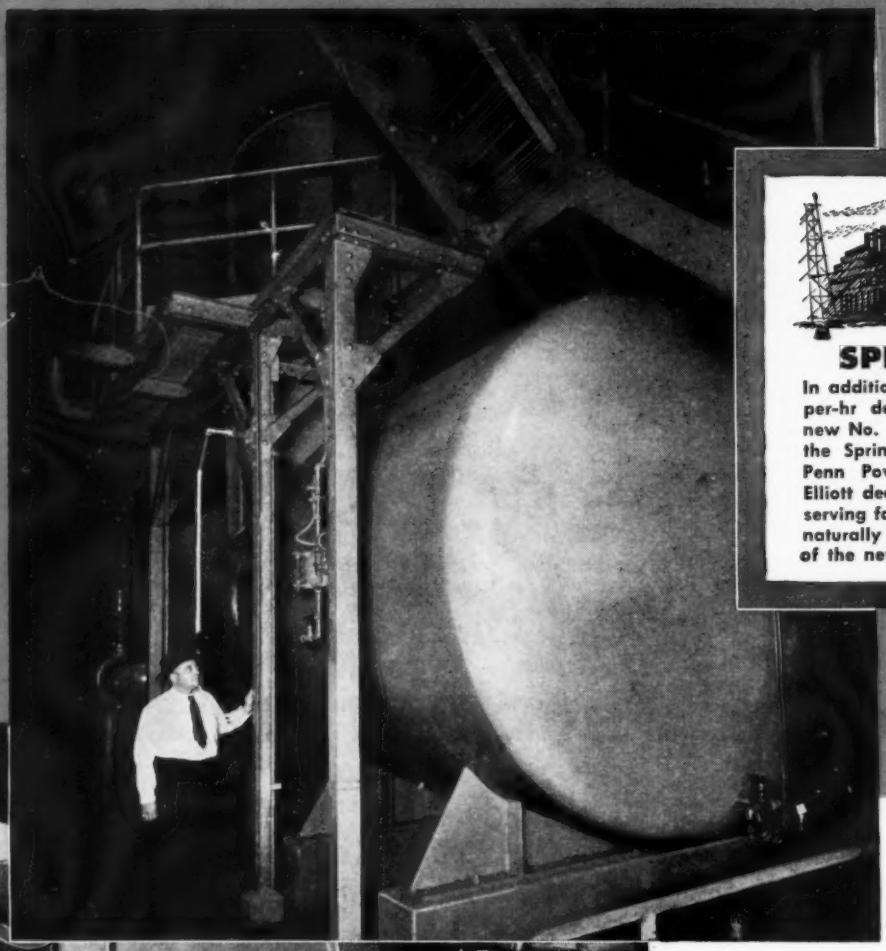
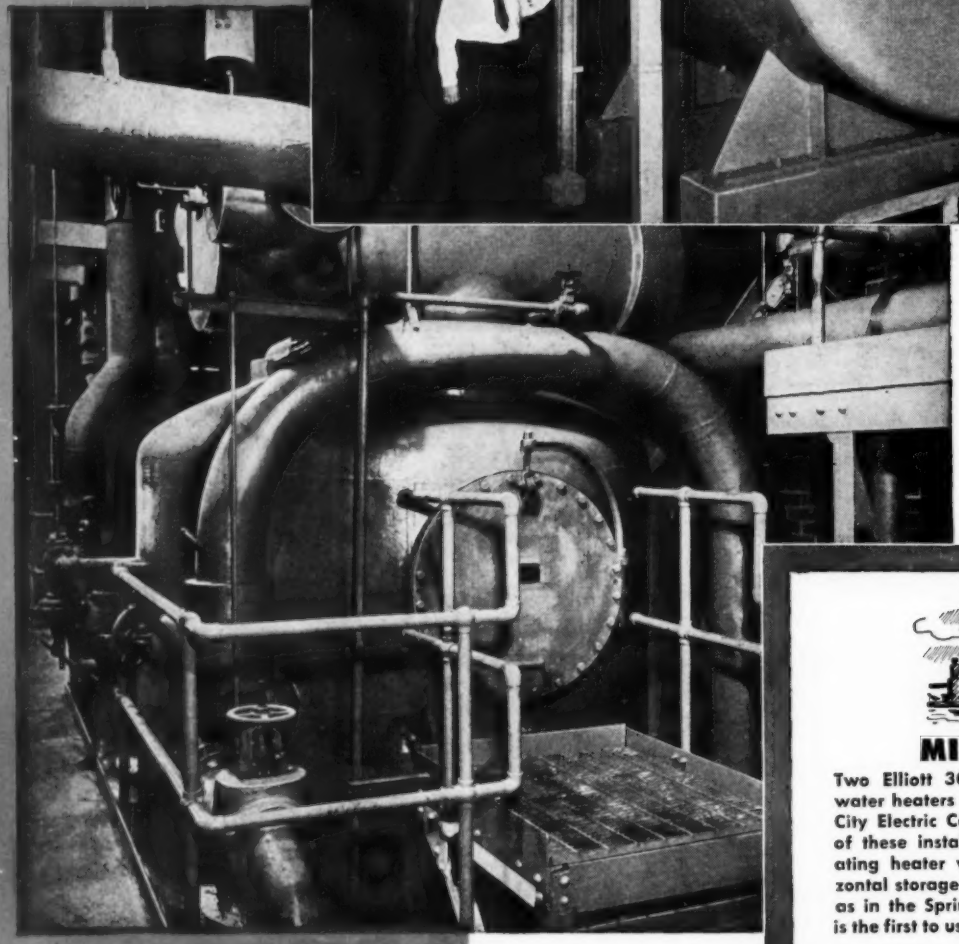


SPRINGDALE

In addition to the 1,000,000-lb-per-hr deaerating heater in its new No. 7 extension, illustrated, the Springdale Station of West Penn Power Company has an Elliott deaerator which has been serving faithfully for 22 years — naturally a factor in the selection of the new deaerating heater.

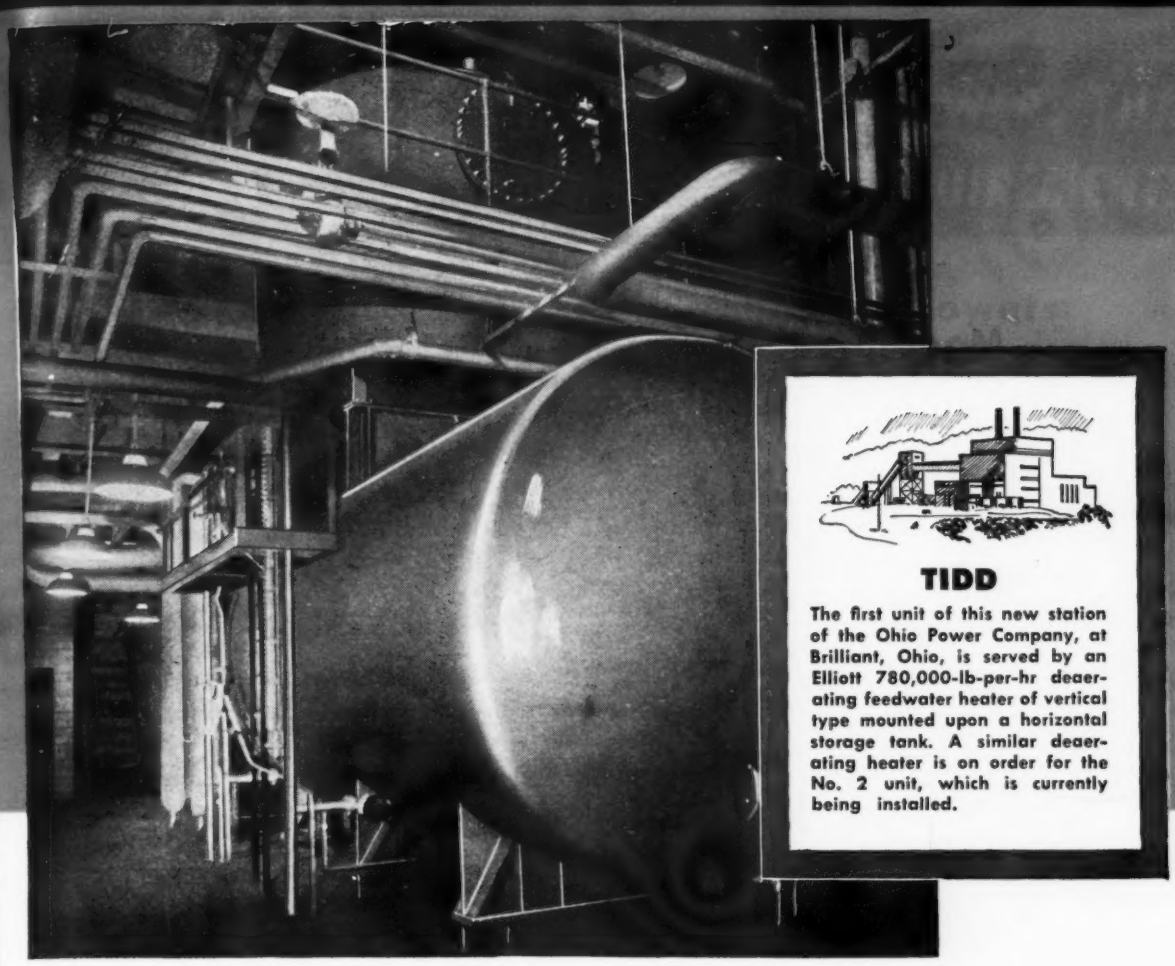


Big, up-t

MISSOURI AVE.

Two Elliott 300,000-lb-per-hr deaerating feedwater heaters serve units 6 and 7 of the Atlantic City Electric Company. The photo, of the newest of these installations, shows the vertical deaerating heater with its vent condenser. The horizontal storage tank is located beneath the heater, as in the Springdale and Tidd units. This station is the first to use steam at a temperature of 1000 F.

Elliott



TIDD

The first unit of this new station of the Ohio Power Company, at Brilliant, Ohio, is served by an Elliott 780,000-lb-per-hr deaerating feedwater heater of vertical type mounted upon a horizontal storage tank. A similar deaerating heater is on order for the No. 2 unit, which is currently being installed.

p-to-date stations agree on Deaerating Heaters *by* Elliott

It is a grave responsibility to mount guard against corrosion over the millions of dollars worth of equipment represented in plants such as those shown here. It is a responsibility which is not placed lightly.

In the three fine stations represented here, this vital task is entrusted to Elliott deaerating feedwater heaters. These units deliver in the required quantity, water free of dissolved oxygen, heated to saturated steam temperatures. The ability of these units to serve satisfactorily is based firmly upon sound experience gained through years of application, and stemming from Elliott Company's pioneering in the early history of deaeration.

Whether for an important utility, or for a comparatively small industrial power plant, Elliott enginers are prepared to evaluate attendant conditions and to supply deaerating heater capacity conforming to installation requirements. Let us discuss it.

Deaerating heater bulletin on request.

N-980

OMPANY
erator and Heater Department
JEANNETTE, PA.
s at: JEANNETTE, PA. • RIDGWAY, PA.
INGFIELD, O. • NEWARK, N. J.
TRICT OFFICES IN PRINCIPAL CITIES

STEAM TURBINES • GAS TURBINES • GENERATORS • MOTORS • CONDENSERS
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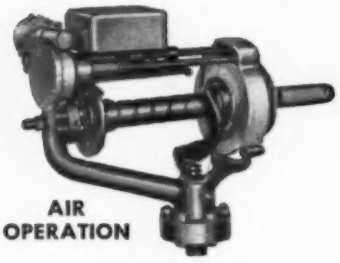
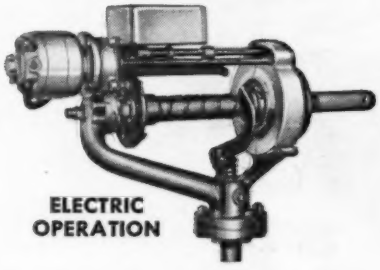
CENTRIFUGAL BLOWERS • TURBOCHARGERS FOR DIESEL ENGINES
TUBE CLEANERS • STRAINERS • DESUPERHEATERS •

Efficient BOILER OPERATION

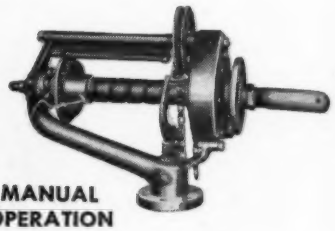
DIAMOND Model IR Short Retracting Soot Blowers



AIR OPERATION



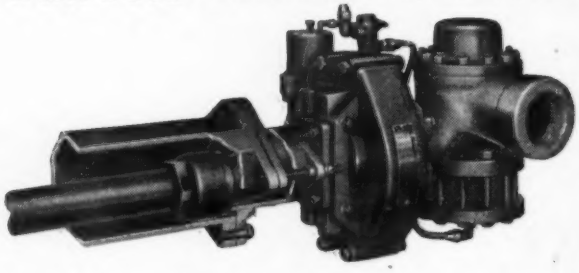
ELECTRIC OPERATION



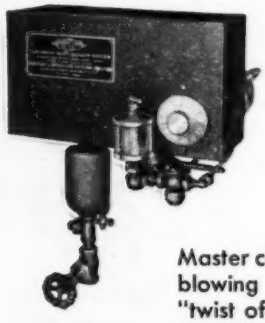
MANUAL OPERATION

For cleaning either furnace walls or boiler heating surfaces where gas temperatures exceed limit for permanently installed units. Equally applicable to compressed air or steam as cleaning medium. Important advantages include: positive poppet type valve, 12″ travel, no lubrication, 360° blowing without additional advance of nozzle, simple, etc.

DIAMOND Model A2E Automatic Air Puff Soot Blowers

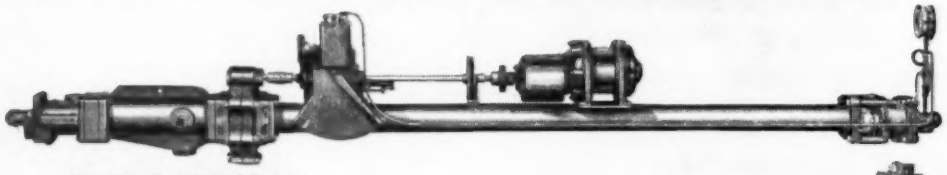


Cleans heating surfaces by series of compressed air puffs delivered through standard multiple nozzle blowing element. Spreading cleaning cycle over longer time permits smaller compressor and receiver . . . also eliminates stack discharge nuisance.

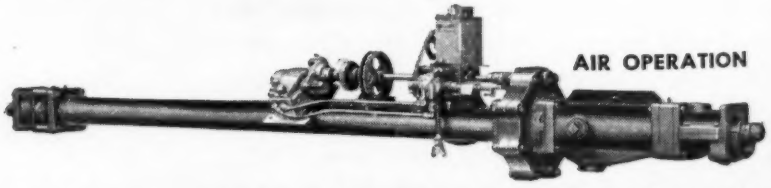


Master controller automatically controls blowing time and sequence. Just a "twist of the wrist" to open valve . . . controller does rest. Automatic control assures correct boiler cleaning.

DIAMOND Telescopic Retracting Soot Blowers



ELECTRIC OPERATION



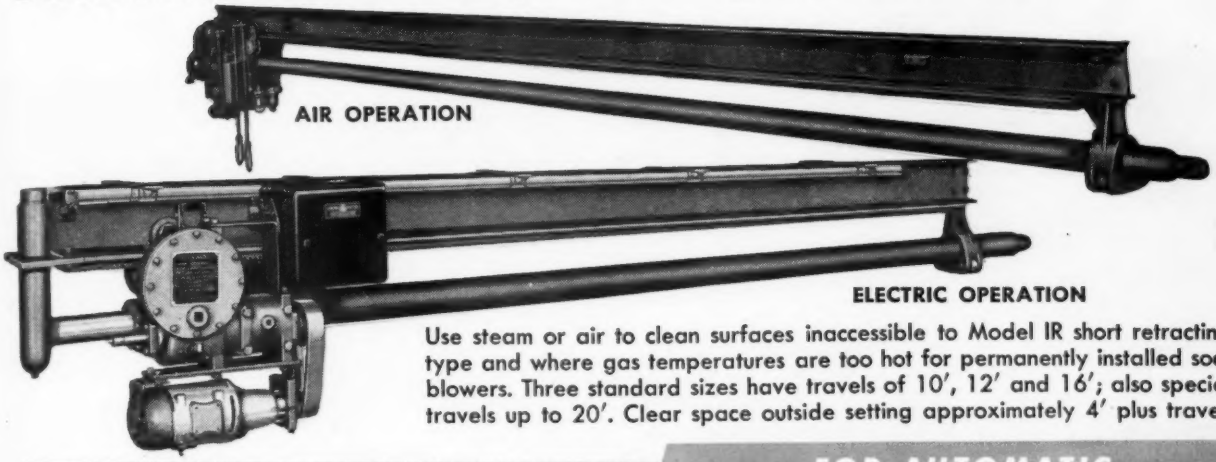
AIR OPERATION

Used where insufficient clear space outside boiler will not permit installation of Model IK retracting blower for cleaning surfaces inaccessible to short retracting blower and where gas temperatures are too hot for permanently installed units. Standard 16′ travel requires approximately 12′ clear space outside boiler; special travels up to 20′. Uses air or steam as cleaning medium.

DIAMOND POWER SPECIALTY CORP.

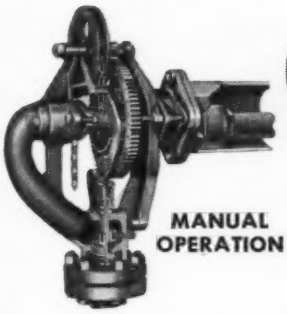
REQUIRES THE SELECTION OF SOOT BLOWERS THAT EXACTLY SUIT YOUR INDIVIDUAL REQUIREMENTS

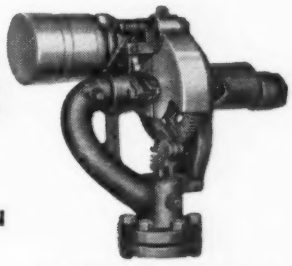
DIAMOND Model IK Long Retracting Soot Blowers



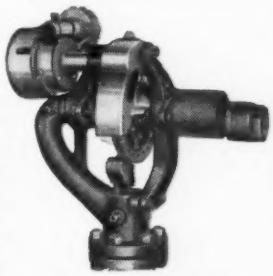
Use steam or air to clean surfaces inaccessible to Model IR short retracting type and where gas temperatures are too hot for permanently installed soot blowers. Three standard sizes have travels of 10′, 12′ and 16′; also special travels up to 20′. Clear space outside setting approximately 4′ plus travel.

DIAMOND Model G9B Soot Blower

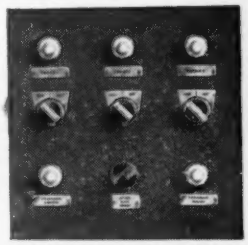




Uses steam as cleaning medium through multiple nozzle blowing element permanently installed inside setting. "Automatic Valved" requiring only one continuous operation to open and close valve in head and simultaneously rotate element. Other important features: adjustable pressure control unit, clockwise or counterclockwise rotation, 360° blowing arc, etc.

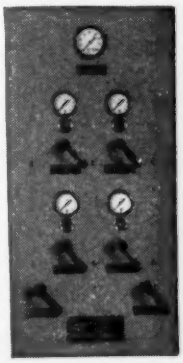


FOR AUTOMATIC SEQUENTIAL SOOT BLOWING



DIAMOND ELECTRIC CONTROL PANEL

Correct cleaning is always assured and labor is saved. "Human element" is eliminated as operator normally only presses start button or opens master control valve. Each blower unit must operate in correct sequence and at right speed every time. No blower can be overlooked or incorrectly operated. Labor is saved because no need for attendant to warm up piping, drain it, and then operate each blower unit manually. Blower grouping can sectionalize heating surface into zones to maintain normal heat absorption by different frequency of group operation. System can be completely air or electric operated and controlled . . . or combination of both.



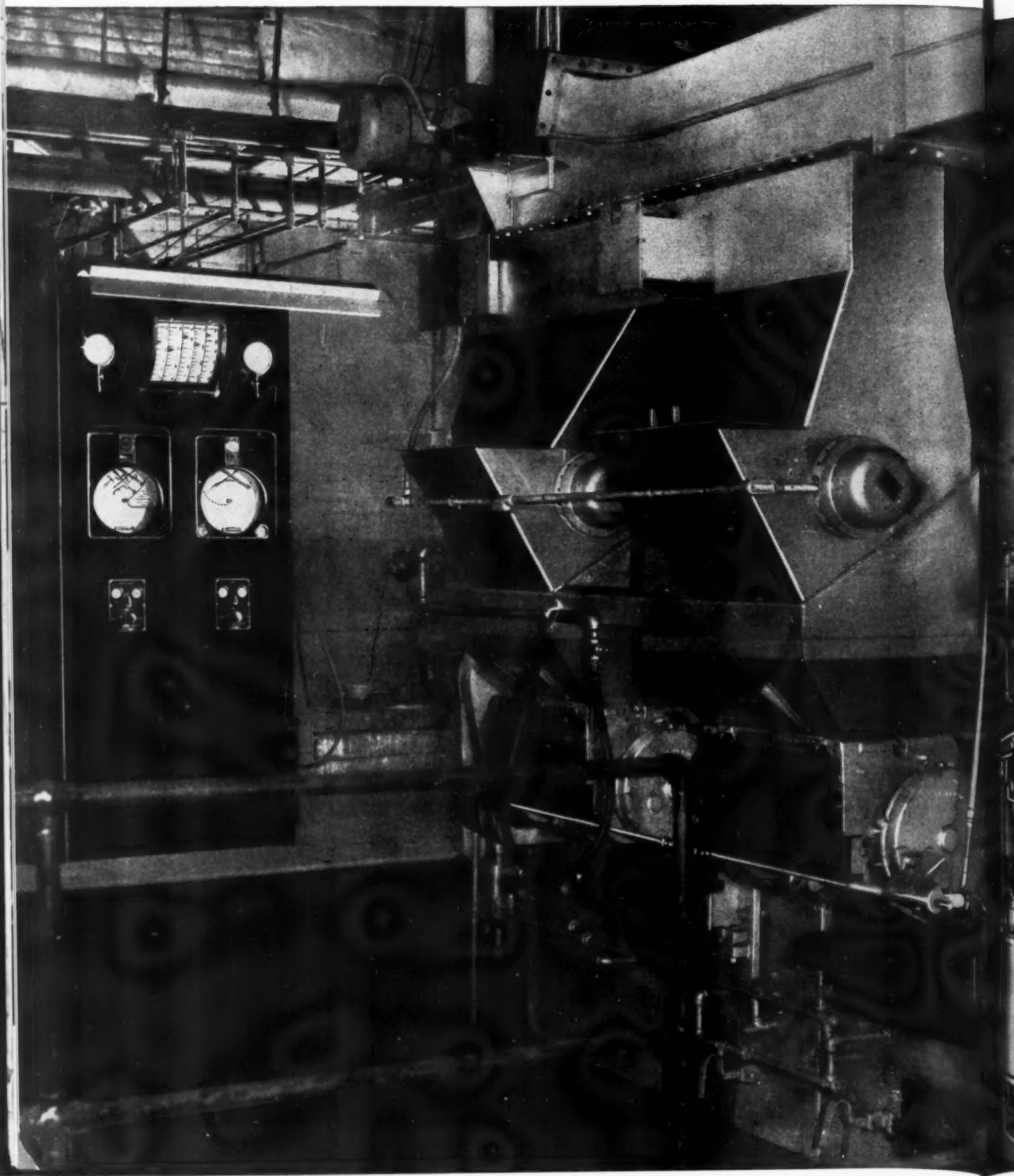
DIAMOND AIR CONTROL PANEL

DIAMOND SOOT BLOWERS . . . *the Most Complete Line*

DETROIT 31, MICH. • DIAMOND SPECIALTY LIMITED—Windsor, Ontario

3080

installations like t



e this . . . cut power costs

★ This picture is worth a second look. It shows how Engineers are conserving fuel and reducing power costs at International Braid Co., Providence, R. I.

This is an on-the-job picture of Bailey Co-ordinated Boiler Control—the type of control you should now be using to get the most steam for the fewest fuel dollars. With this control you will increase operating safety and improve continuity of service.

The Bailey control drive, shown in the right foreground of this picture, is connected to the coal feed lever of the spreader stoker and regulates the lever in accordance with steam pressure. Similar control drives regulate forced and induced draft dampers to maintain steam pressure, combustion efficiency and furnace draft. In this installation, combustion and feed water controls are co-ordinated to assure optimum boiler operation.

The user reports that prior to installation, it was common to have wide pressure swings during the day. A decided improvement was obtained when this control was installed.

Like all Bailey co-ordinated Boiler Control installations, this one was designed and engineered to the specific job—the same as yours will be. Bailey engineers will work directly with you and your engineers in the application of the meters and controls required by your boilers.

Why not discuss your power problems with a Bailey Engineer? You may be surprised, as many others have, to discover how quickly Bailey Co-ordinated Boiler control will pay for itself in fuel saved. Records show that in many cases installation costs have been returned in less than one year.

A-102

BAILEY METER COMPANY

1036 IVANHOE ROAD • CLEVELAND 10, OHIO

Controls for Steam Plants

BAILEY METERS

COMBUSTION • FEED WATER • TEMPERATURE
PRESSURE • LIQUID LEVEL • FEED PUMPS

THE C-E PACKAGE Gives Top Performance at Minimum Cost

Here's why...

The C-E Package Boiler was *designed for specific service* – industrial loads, particularly in plants having small operating and maintenance forces. Consequently, every element is combined in *balanced relationship* to produce definitely planned operating advantages – efficiency over a wide range of output, ability to take rapid load swings, the production of steam of satisfactory quality at all ratings, together with simplicity of operation and minimum maintenance.

No assembled compromise could insure such results. Required is the complete coordination of all components – *balanced design* – by a single manufacturer who controls every element of design and construction. C-E does this, and with *one* contract, *one* guarantee and *one* responsibility, provides the top performance you have a right to expect from years of leadership in steam generating equipment.

Moreover, you gain the benefit in the purchase price of the savings made possible by standardized design. And in efficiency, simplicity of operation and low maintenance, you have added savings that lower costs substantially.

It is not surprising that plants in widely different industries have selected the boiler of balanced design for top performance at minimum cost.

If you are in need of new steam generating equipment it will pay you to investigate the advantages of the C-E Package Boiler. B-157

Fully descriptive catalog on request.

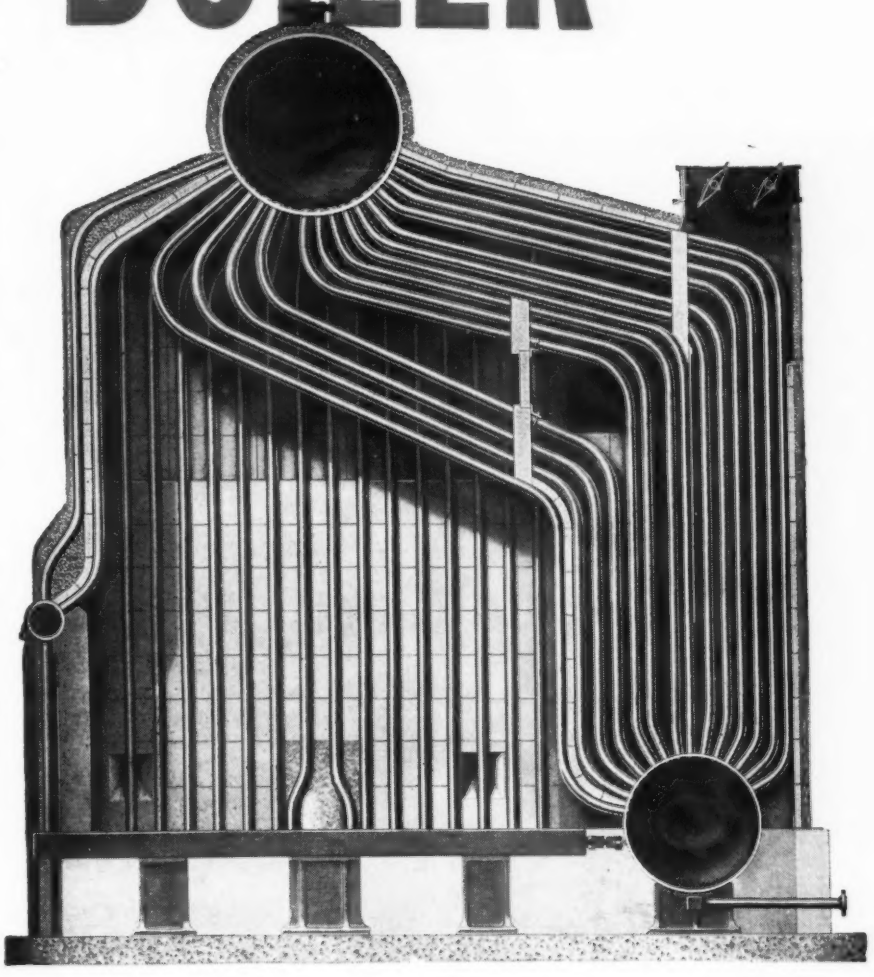
Partial list of industries that have selected the C-E Package Boiler during the past year:

Bakery	Leather	Paper
Chemical	Linoleum	Railroads
Dairy	Machinery	Rubber
Glass	Metals	Textile
Hospital	Packing	Tobacco
Hosiery	Paints	Utility

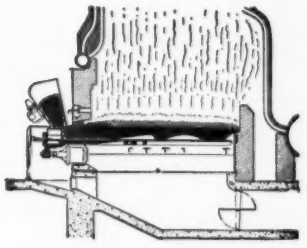
COMBUSTION

C-E PRODUCTS INCLUDE ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; ALSO MANY TYPES OF PRESSURE VESSELS

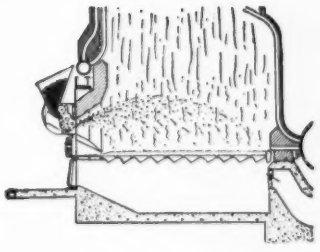
BOILER



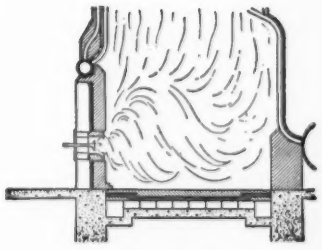
Furnished in capacities of
15,000 to 50,000
lb of steam per hr
the Package Boiler is designed for four methods of firing — spreader stoker, single-retort underfeed stoker, oil or gas burners. Any of these methods may be substituted for any other should a change in the fuel market occur.



Type E Underfeed Stoker



Spreader Stoker



Oil or Gas Burner

MAINTENANCE ADVANTAGES

1. Any tube in the furnace or boiler convection bank can be removed and replaced without disturbing any other tube.

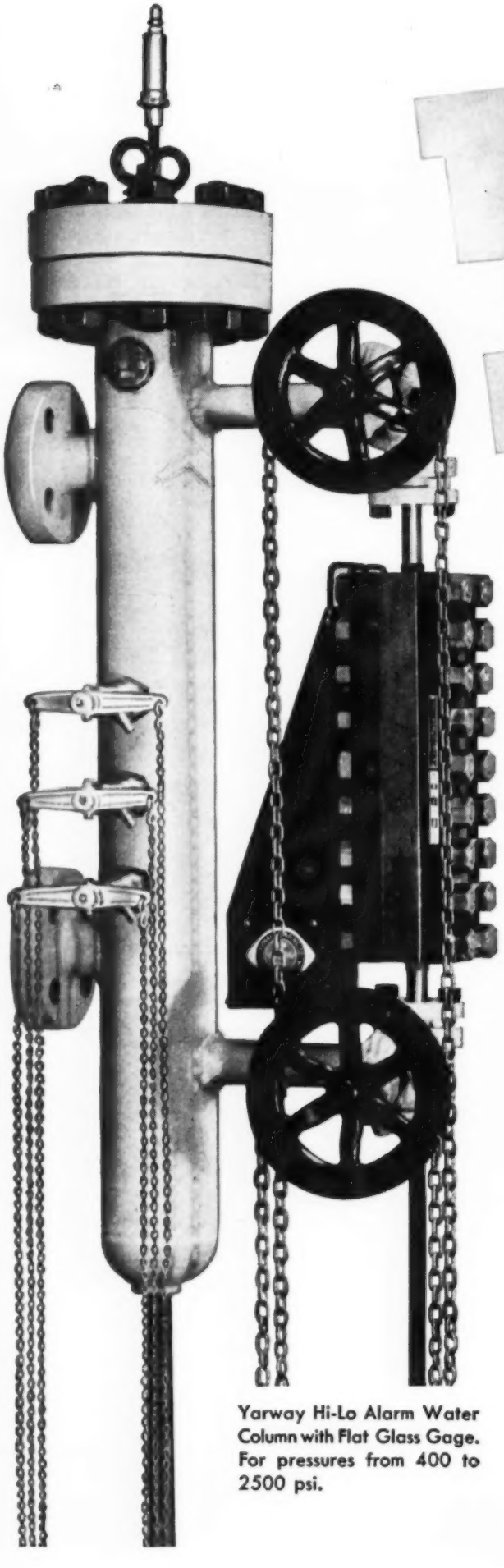
2. Amply sized tubes reduce tendency for solids to deposit and are easier to clean. All tubes can be de-scaled from top drum.

3. Integral soot blowers enable the operator to keep tube surfaces clean.

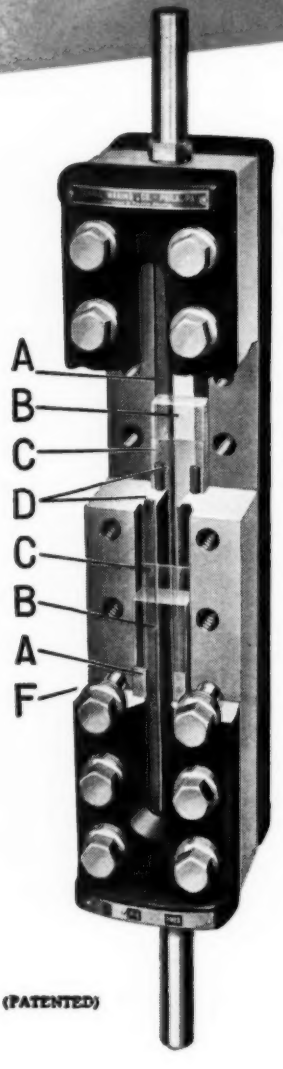
4. Front and side walls of the furnace are fully water-cooled, virtually eliminating refractory maintenance.

ENGINEERING
200 MADISON AVENUE • NEW YORK 16, N. Y.

YARWAY REDUCES LEAKAGE



Yarway Hi-Lo Alarm Water Column with Flat Glass Gage. For pressures from 400 to 2500 psi.



(PATENTED)

Cut-away section of Yarway Flat Glass Gage. Shows asbestos gaskets (A) placed between cover plates and outer faces of glasses (B).

Front and back cover plates are independently fastened to body by special shouldered cap screws fitted with spring cones (F) which automatically limit the amount of pressure on glasses and gaskets and, at the same time, take up expansion and contraction. Special molded gaskets (D) provide tight pressure sealed joints between body and glasses. Inner surfaces of gage glasses are protected by India ruby mica (C).

YARWAY

"Floating Assembly"
FLAT GLASS GAGE AND GLASS BREAKAGE

Leakage between gasket and glass, or between gasket and body on flat glass gages is a frequent source of trouble to boiler plant operators. The trouble occurs when the gage cools each time it is cut out of service. Starting with dripping, the trouble becomes serious when steam blows through, cutting gasket, mica and glass . . . resulting in high maintenance cost.

As a cure, the cover plates are sometimes forced down hard on packings and glasses, frequently breaking glasses and thereby increasing the trouble.

Yarway has a better solution . . . a distinctive "floating assembly."

Careful tests in the Yarway Research Laboratory and several years of field service have shown that to prevent leakage and excessive loading of glasses, some flexible feature is required. *Spring cones under the cap nuts fastening covers and glasses in place provide this flexibility.* This spring cone loading or "floating assembly" is predetermined. The loading is maintained by accurately machined cap screws which shoulder on the insert body, limiting the spring cone load to that actually required. *Thus cover plates are independently adjusted.*

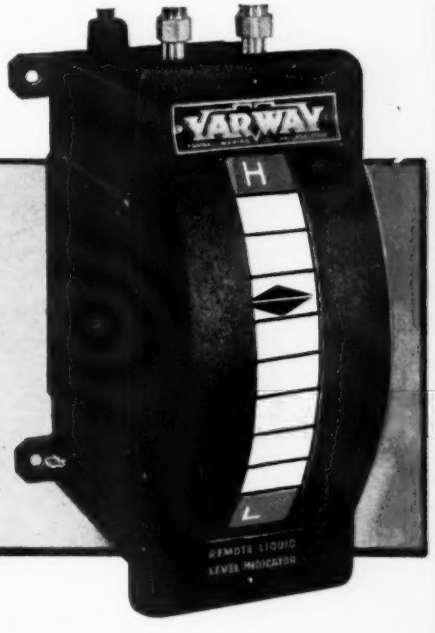
For the full story—including other features of Yarway Water Columns and Gages—write for Yarway Bulletin WG-1811.

YARNALL-WARING COMPANY • 100 Mermaid Avenue, Philadelphia 18, Pa.

BRING THE OVERHEAD GAGE READINGS DOWN TO EYE LEVEL WITH THIS YARWAY REMOTE BOILER WATER LEVEL INDICATOR

This widely used instrument brings the overhead gage reading down to eye level at any desired location. Readings are on a brilliantly-lighted dial. Indicator is always accurate because it is operated by the boiler water itself—by the pressure differential between a constant head of water and the varying head in the boiler drum. Action is instant, constant. *There are no stuffing boxes.* Easy to install and moderate in price. Suitable for all pressures to 1500 psi.

Completely described in Bulletin WG-1822.



STEAM PLANT EQUIPMENT

For maximum *flexibility*

the Hagan Differential Master system

Until a very few years ago, virtually every boiler installation was designed for a single fuel. There was no question, in a given area, as to what fuel would be used by plants in that area.

Today, study of the fuel situation is usually one of the first steps in designing a steam plant. In an increasing number of cases, it is found that, for maximum fuel economy and for insurance against fuel shortages, the installation should be flexible enough to permit the use of two, three or even more fuels. In some installations these fuels are used singly; in others, it may be necessary to burn two or more fuels together in varying combinations.

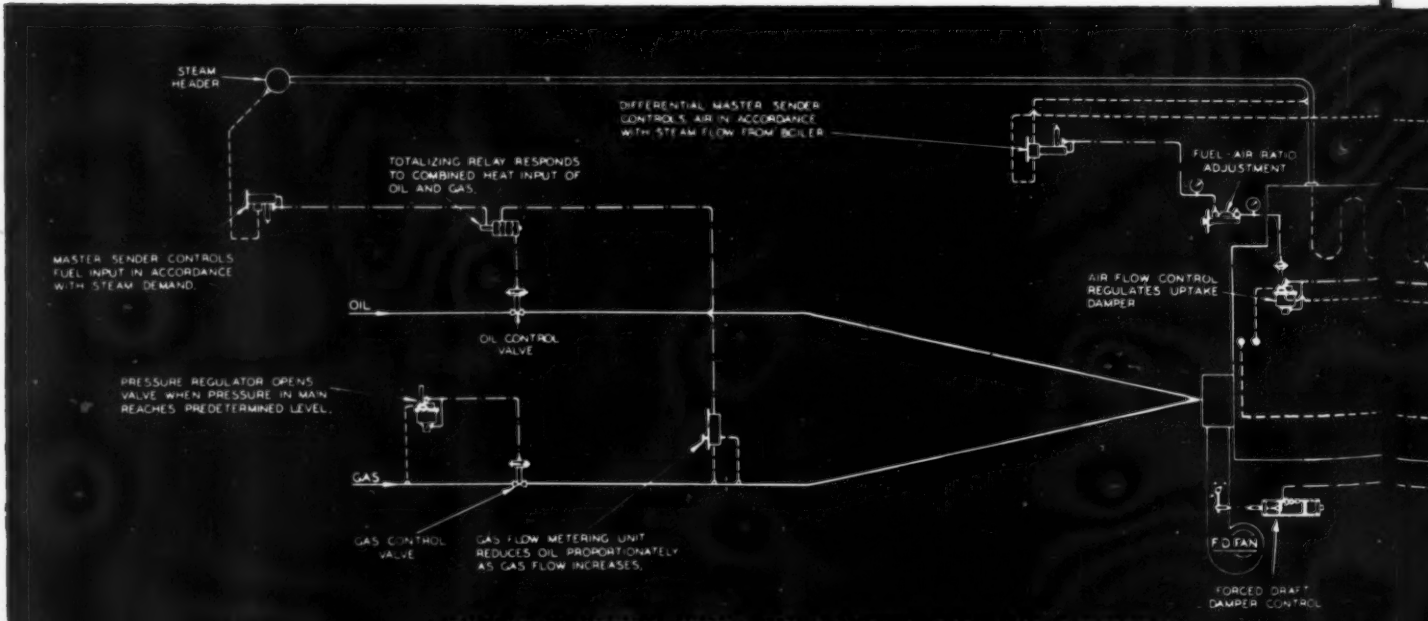

STEAM HEADER
DIFFERENTIAL MASTER SENDER CONTROLS AIR IN ACCORDANCE WITH STEAM FLOW FROM BOILER
FUEL-AIR RATIO ADJUSTMENT
TOTALIZING RELAY RESPONDS TO COMBINED HEAT INPUT OF OIL AND GAS.
MASTER SENDER CONTROLS FUEL INPUT IN ACCORDANCE WITH STEAM DEMAND.
AIR FLOW CONTROL REGULATES UPTAKE DAMPER
OIL
OIL CONTROL VALVE
PRESSURE REGULATOR OPENS VALVE WHEN PRESSURE IN MAIN REACHES PREDETERMINED LEVEL.
GAS
GAS CONTROL VALVE
GAS FLOW METERING UNIT REDUCES OIL PROPORTIONATELY AS GAS FLOW INCREASES.
F.D. FAN
FORCED DRAFT DAMPER CONTROL

DIAGRAM OF CONTROL SYSTEM USED IN REFINERY. WASTE GAS IS BURNED AS AVAILABLE; AUTOMATICALLY SUPPLEMENTED OR REPLACED BY OIL AS NECESSARY.

in the use of fuels

of automatic combustion control

The key to maximum flexibility in the use of fuels is the Hagan Differential Master system of automatic combustion control.

With this system, excess air is correctly and automatically controlled at all times. You can burn gas, oil, coal or any combination of these fuels; the B.t.u. value of each may fluctuate; coal may be dry or wet, large or small, screened or run-of-mine—but excess air is kept constant.

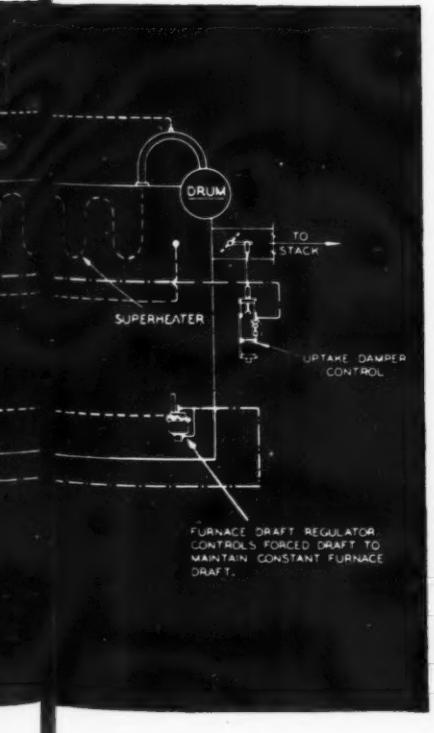
This is accomplished simply and directly. A *Master Sender,* sensitive to steam header pressure, controls the rate of fuel feed so that B.t.u. input is in accordance with demand. A *Differential Master Sender,* measuring steam flow, regulates air flow.

Each of these units has its own function, and performs that function *directly.*

The rate of fuel feed is changed instantly to compensate for any change in steam demand, for any fluctuation in calorific value of fuel, or for any variation in feeder characteristic.

Air, however, is changed *only when there is an actual change in heat input to the furnace, as shown by a change in steam flow.*

The Hagan Differential Master system will help you meet changing fuel situations in the future—and right now it will give you better control of combustion and substantial fuel savings. Our engineers will be glad to discuss its possibilities in your plant.



HAGAN HALL BUROMIN CALGON

Hagan Corporation, Hagan Building, Pittsburgh 30, Pennsylvania.

HAGAN CORPORATION

BOILER COMBUSTION CONTROL SYSTEMS
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
THRUSTORQ FORCE MEASURING DEVICES

Why still another big Turbine gets Nonpareil protection

Take a look at the record made by Nonpareil Turbine Oil in this large midwest utility plant.

Eight years ago Nonpareil was installed in one turbine—a 36,750 KW unit. Two years later a shift to Nonpareil was made on a second turbine—of 37,500 KW—and shortly after that on a third—another 36,750 KW unit.

Recently a new 37,500 KW turbine was put into service, and the job of lubricating it went to Nonpareil—making a total of 148,500 KW capacity which Nonpareil protects for this one utility.

What are the facts back of this record? In the six to eight years of operation on Nonpareil, neutralization numbers have stayed between .04 and .06. Losses and troubles caused by high acidity have been completely absent.

Nonpareil is the only product in its field that carries a written guarantee to last as long as your turbine without increasing in acidity above a neutralization number of 0.15. This guarantee, backed by 20-year performance records, is your assurance of trouble-free turbine operation with Nonpareil.

If you are installing new turbines, let a Standard Oil Lubrication Engineer explain how Nonpareil brings real economy in equipment, plant space, and total investment. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY (INDIANA ST

NONPAREIL
TURBINE OIL

STANDARD OIL COMPANY (INDIANA)

STANDARD

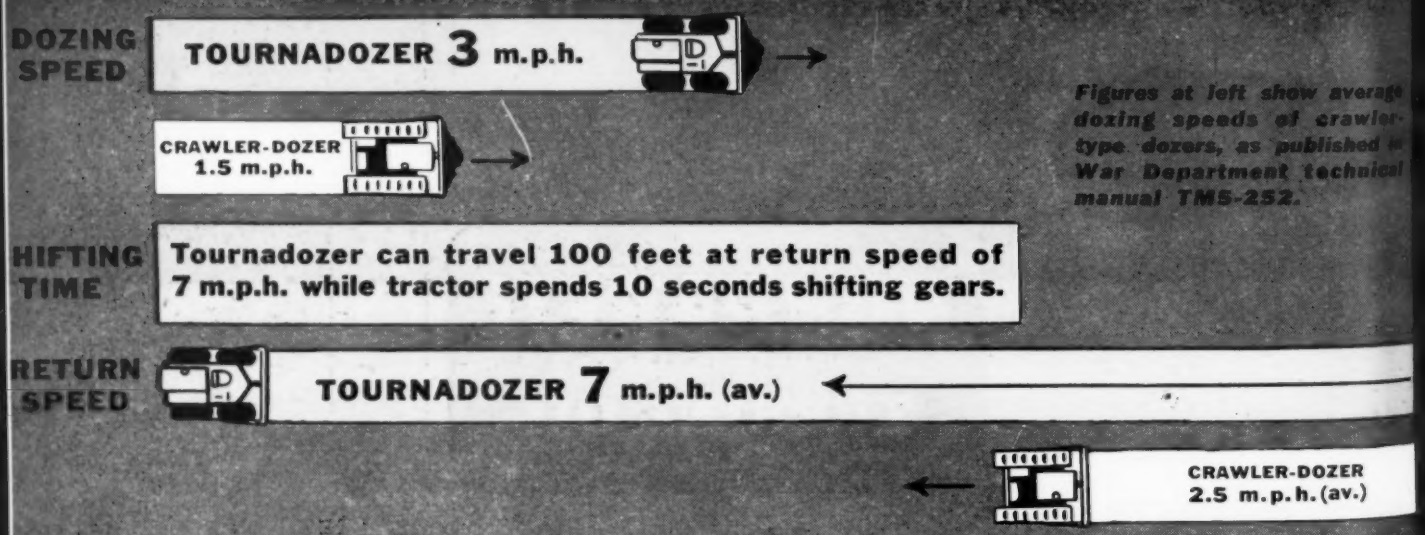
High Speed TOURNADOZER

Faster Dozing

Compare cycle time ... figure production

TOURNADOZER gives you double the average dozing speed forward . . . three times more speed in reverse. In addition, instantaneous speed selection saves up to 10 seconds every time you shift gears. Big rubber tires and 15 m.p.h. top speed get Tournadozer anywhere around your plant in a hurry. Fast, self-powered job-to-job moves over pavement or plant floors reduce your non-productive move time . . . eliminate expensive hauling and planking charges. Tournadozer enables you to get more work done at lowest net cost. Mail coupon at right for complete facts. DO IT NOW!

Increased speed plus instantaneous s


DOZING SPEED
TOURNADOZER 3 m.p.h.
CRAWLER-DOZER 1.5 m.p.h.
SHIFTING TIME
Tournadozer can travel 100 feet at return speed of 7 m.p.h. while tractor spends 10 seconds shifting gears.
RETURN SPEED
TOURNADOZER 7 m.p.h. (av.)
CRAWLER-DOZER 2.5 m.p.h. (av.)

Figures at left show average dozing speeds of crawler-type dozers, as published in War Department technical manual TM5-252.

LE TOURNEAU LET EQUIPMENT

See your Le Tourneau Distributor NOW for complete information

Gives You Cycles

E AND MAIL TODAY

R. G. LeTOURNEAU, INC., Peoria 3, Illinois

☐ Send facts on 180 h.p. "C" Tournadozer

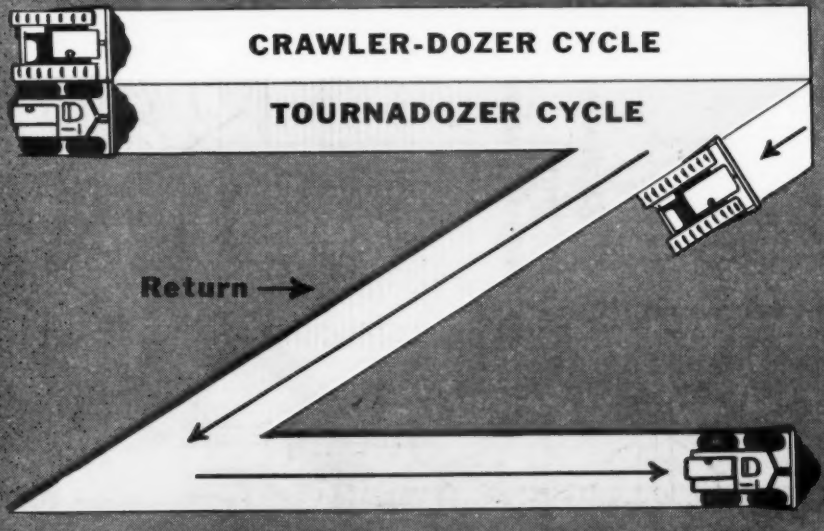
NAME.....

COMPANY..... TITLE.....

ADDRESS.....

Tournadozer—Trademark R127-I

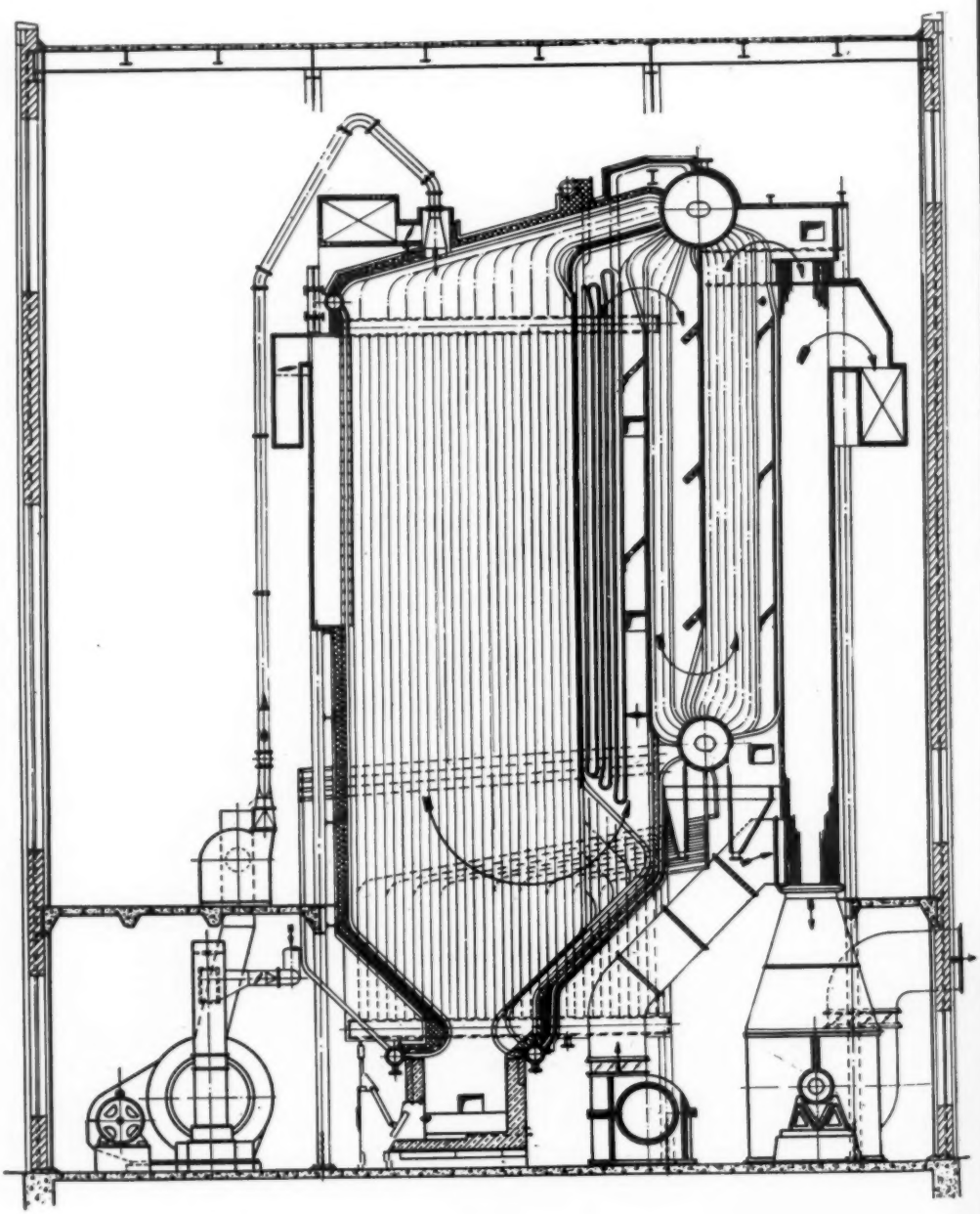
shift cut non-productive dozer time



Ideal for stockpiling coal or other materials at low cost... 4 giant low-pressure rubber tires give compaction without damage ... reduce danger of combustion.

LETOURNEAU PEORIA, ILLINOIS HIGH-SPEED RUBBER-TIRED TOURNADOZERS

KVS engineering



# of SHADOW WALLS

provides for wide load range on all fuels

The Kennedy Shadow Wall embodies all desirable features: low first cost, low maintenance, and ability to maintain a high furnace temperature at low or high ratings resulting in high furnace efficiency.

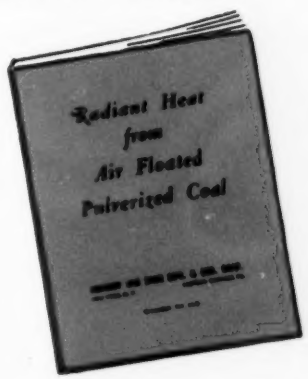
In the Kennedy Shadow Wall the tubes are set at a predetermined distance from the refractory wall, and spaced in such a manner that the refractory wall is under the cooling effect of the water tubes. At low ratings approximately one-half of the tube surface absorbs radiant heat; that is, that part of the tube facing the flame. If the rating is increased, the refractory progressively becomes hotter and automatically reflects heat to the back of the water tubes. Thus the total tube surface is exposed to radiant and reflected heat from the refractory wall.

With a bare metal tube wall it is obvious that only one-half of the total tube surface absorbs radiant heat, at all ratings. At full load, the KVS Shadow Wall provides 100% of the tube wall surface to absorb radiant and reflected heat.

The Kennedy Shadow Wall also affords an automatic regulation which keeps the furnace temperature within a range consistent with high furnace efficiency. No sacrifice is made at either low or high ratings. At high ratings the refractory is still well within safe working temperatures.

We have not featured KVS Air Swept Tube Mills with automatic controls here, because we believe the industry recognizes their superiority.

All other components of KVS Steam Generating Units are engineered to meet specific operating conditions on available fuels in order to assure the maximum in operating efficiency and economy at all boiler ratings.



KVS ENGINEERING SERVICE

KVS Steam Generating Equipment has been performance proved over the years. KVS offers a complete service in design, building and erecting complete plants under one responsibility. KVS engineers are available for consultation on your requirements.

Ask for a copy of 97-page Engineering Bulletin No. 44-B containing valuable information on preparation of pulverized fuel and steam generating plants.

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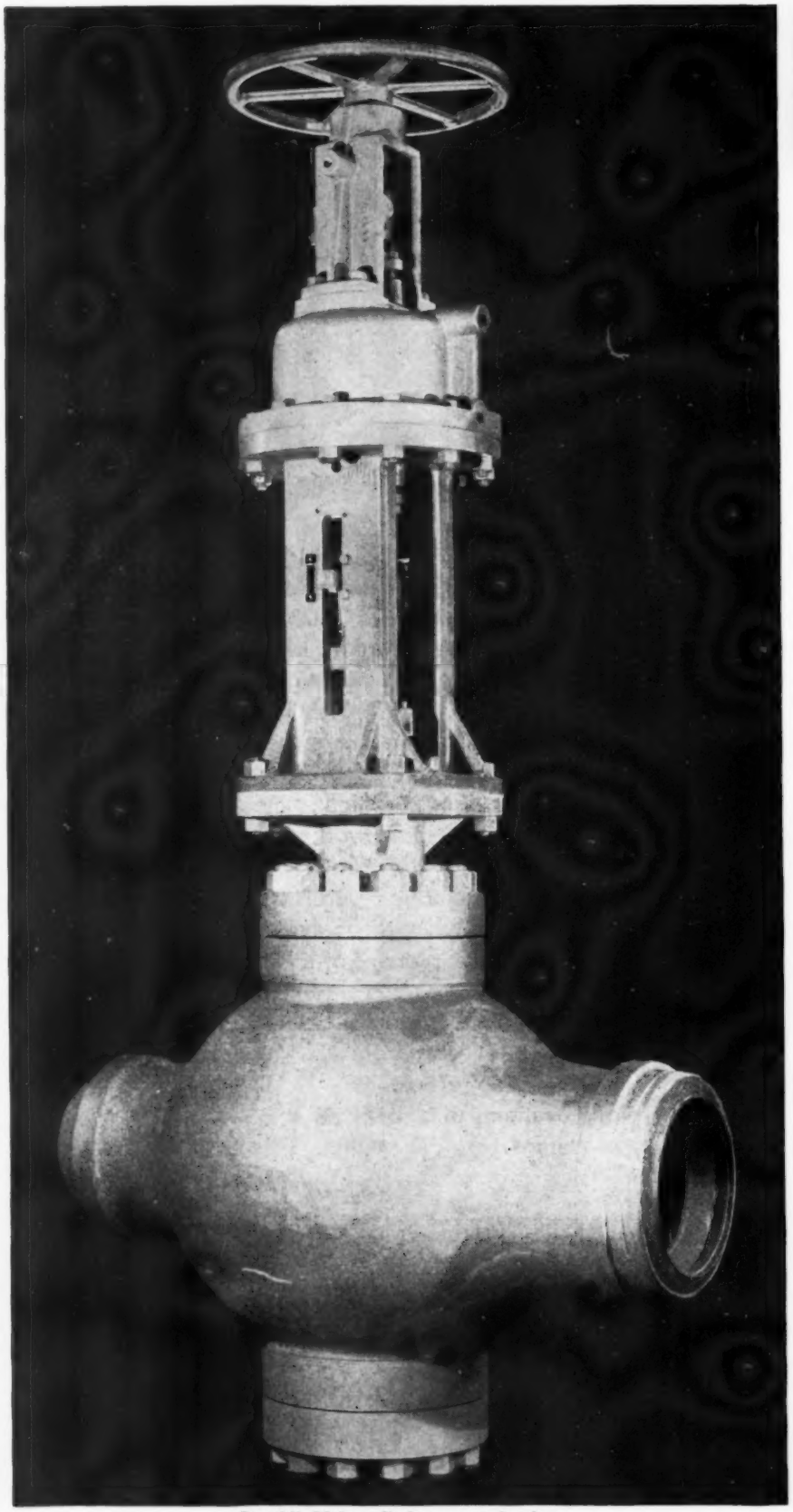
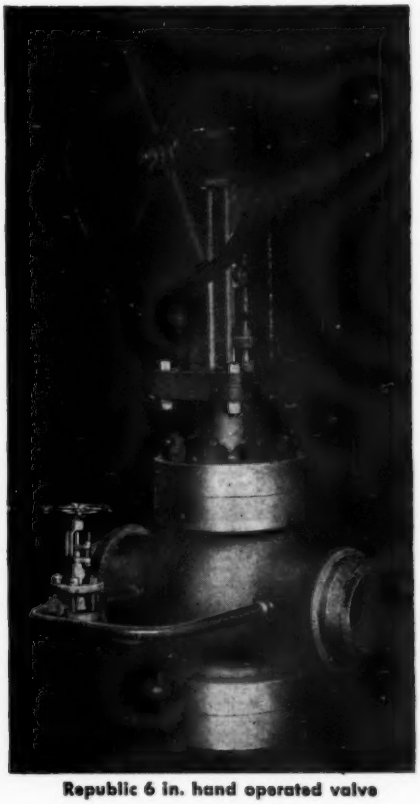


Republic 12 in. cylinder operated valve

REPUBLIC

GENERAL SPECIFICATIONS

- Built in all pressure standards—both flanged and welded ends.
- Streamlined flow through parts virtually eliminates erosion.
- Single seated valves—guaranteed drop tight.
- Double seated valves—guaranteed maximum leakage less than 1/2%.
- Steam valves have heat treated stainless steel trim with screwed in seats.
- Water valves have welded in seat rings with hard surface overlay—on small valves overlay is made directly on body.
- All valves are engineered to the job or application.



Republic 6 in. hand operated valve

REPUBLIC FLOW METERS CO.

VALVES REPUBLIC

Regulating — Pressure Reducing — Shutoff

CYLINDER OPERATED—double seated

Republic cylinder operated valves are of the gradual opening, high lift, double seated type. They are hydraulicly operated to assure smooth performance at any speed regardless of size, static pressure or pressure reduction. These valves are available in sizes from 3″ to 24″, with or without hand operating wheel. Due to compact design, a regulator may be mounted directly on the valve.

HAND OPERATED—large sizes

Republic hand operated valves, in sizes from 3″ to 8″, are built to 900 lb. and 1500 lb. pressure standards. They are of the single seated type, have a one piece valve stem, and seat rings that are Stellite surfaced and welded in place. The gear reduction head is built with ball or roller bearings and precision ground gears for minimum friction and back lash. These valves are recommended for flow control and shutoff applications.

HAND OPERATED—small sizes

Republic single seated hand operated valves are also available in 1″, 1½″ and 2″ sizes, built to 600 lb., 900 lb. and 1500 lb. pressure standards. These valves also have a one piece valve stem, and a Stellite surfaced seat integral with the valve body.

LEVER OPERATED—large sizes

Republic double seated lever operated valves are ideal for air actuation with long stroke cylinders. They are available in sizes from 3″ to 16″ for low pressure applications and in sizes up to 6″ for 1500 lb. applications. The lever mechanism, of sturdy construction capable of taking full strains of power cylinders, is adjustable with full cylinder stroke to change valve capacity.

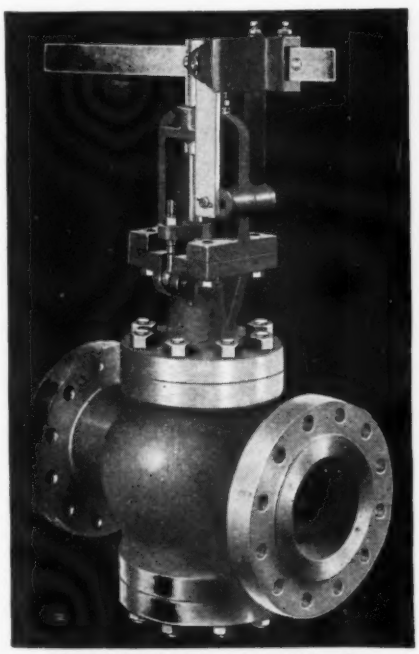
LEVER OPERATED—small sizes

Republic single seated lever operated valves are available in sizes up to 2″ and for pressures up to 1500 lb. standard. The valve seat is Stellite surfaced and integral with the valve body. The sturdy lever mechanism is adjustable for lift. Many of these valves are in operation on water lines with over 1000 lbs. pressure reduction.

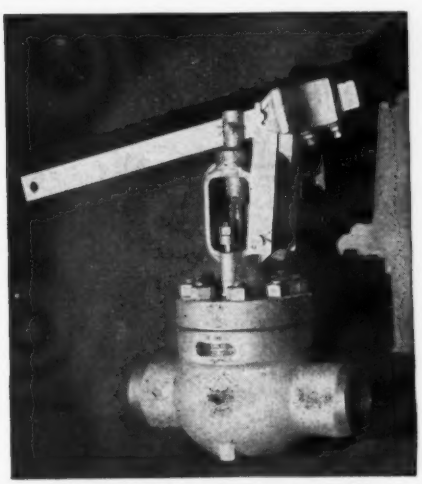
BUTTERFLY VALVES

Republic butterfly valves can be supplied in cast iron or steel for pressures up to 300 lbs. Vanes can be supplied of the angle seating or swing through types. The shaft can be mounted on ball or plain bearings as required. A valve operator may be mounted directly on valves of 6″ size and over.

All Republic valves are engineered to the specific job on which they are to be used. Our engineers will be glad to consult with you on any of your valve problems. Write, asking to have one of our engineers call.



Republic 6 in. lever operated valve



Republic 2 in. lever operated valve

Butterfly valve with operator

2240 Diversey Pkwy., Chicago 47, Illinois

now!

a simple a-c with 3 to 1 speed

TRI CLAD
REG. U.S. PAT. OFF.

Type ACA adjustable-speed induction motor

GENERAL ELECTRIC

730-292

motor range

HERE'S WHERE TO USE IT!

Textile
- Slashers
- Knitting machines
- Individual finishing machines
- Spinning frames
- Printing machines

Chemical
- Shakers
- Grinders
- Pulverizers
- Mixers
- Liquid pumps
- Solids pumps

Metal-Working
- Drawbenches
- Lathes
- Stamping presses
- Milling machines
- Grinders

Printing
- Job presses
- Coating machines
- Trimming machines
- Stitching machines
- Rotary web presses

Food
- Ovens
- Proofers
- Mixers
- Fillers
- Labelers
- Grinders
- Centrifugals
- Conveyors
- Shaker Screens
- Pumps
- Blanchers

Paper
- Winders
- Slitters
- Supercalenders
- Coating machines
- Waxing machines
- Embossers
- Other converting machinery
- Stock preparation machinery
- Conveyors

Non-Ferrous & Rock Products
- Mill feeder drives
- Crusher feeder drives
- Sinter conveyors
- Other conveyors

Yes — you can now get a simple a-c motor and stepless speed adjustment over a 3 to 1 range *in a single, compact enclosure!* At the twist of a dial, the new Tri-Clad Type ACA induction motor changes speed quickly and accurately without *any power converting equipment.* Practically no different looking than any other induction motor, the Type ACA is a simple, economical way to equip old and new machines with an adjustable-speed drive and still retain the advantages of a-c motor operation.

Constant torque at any speed!

This new Tri-Clad motor provides constant torque over the entire 3 to 1 speed range and *holds* its speed despite load changes. Its efficiency and power factor are high at any speed — an important advantage where long operation over most of the speed range is customary. And for EXTRA PROTECTION against physical damage, electrical breakdown, and operating wear and tear, it features sturdy Tri-Clad design and construction.

Up to 50 hp available!

The Tri-Clad Type ACA induction motor with 3 to 1 speed adjustment is now available in ratings from 3 to 50 hp. Standard NEMA dimensions are used. For remote control, a flexible cable or pilot motor are available. Write today for Bulletin GEA-4883. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

You can't beat Tri-Clad Extra Protection!

GENERAL ELECTRIC COMPANY, Section E750-292
Apparatus Department, Schenectady 5, N. Y.

Please send me Bulletin GEA-4883 which describes the new Tri-Clad Type ACA motor:

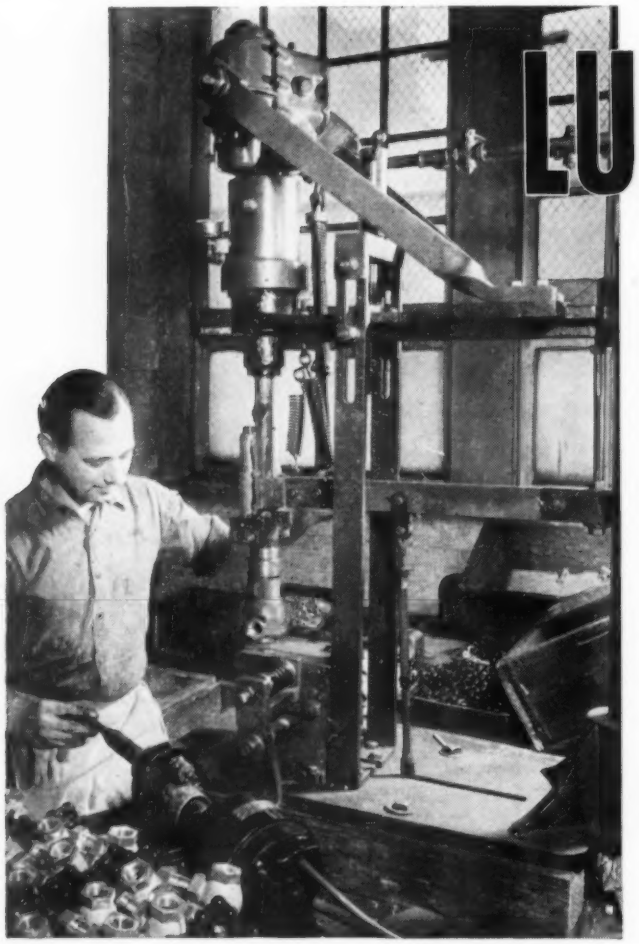
NAME_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____

LUNKENHEIMER



ASSEMBLING REQUIRES NO SPECIAL FITTING

● Assembling is greatly simplified by Lunkenheimer precision production . . . parts are so accurately made that special fitting isn't necessary.

Fig. 2125 Bronze Double Disc Gate

Fig. 1938 Cast Steel Gate

Fig. 1430 Iron Body Gate

Bronze Union Bonnet Gate Valve

BRONZE, IRON, STEEL AND CORROSION RESISTANT ALLOY VALVES
125 TO 2500 LB. S. P. BOILER MOUNTINGS, LUBRICATING DEVICES
AIRCRAFT FITTINGS

Precision Workmanship

■ ■ ■

SUPER-ACCURACY IN EVERY PART . . . LONGER SERVICE LIFE

● You can't fool maintenance men on valve quality. They know that when a valve has a much longer than average service life, that valve has superior accuracy and precision built into it from handwheel to pipe threads.

Such valves are the only kind that have ever been produced by Lunkenheimer. For more than three quarters of a century, the Lunkenheimer quality ideal has won ever widening acceptance until today it is a recognized tradition in American industry.

Lunkenheimer quality is the balanced combination of many factors. Among them are finest raw materials approved by constant testing and research . . . sound, advanced design . . . highly skilled workmanship...absolute accuracy...perfect alignment of all parts. As an inevitable result—wherever you find Lunkenheimer Valves you find maintenance cost records consistently lower.

ESTABLISHED 1862

THE LUNKENHEIMER CO.

"QUALITY"

CINCINNATI 14, OHIO. U. S. A.

NEW YORK 13, CHICAGO 6, BOSTON 10, PHILADELPHIA 34, EXPORT DEPT. 318-322 HUDSON ST., NEW YORK 13, N. Y.

Your LUNKENHEIMER Distributor

—is an important link in the nationwide Lunkenheimer chain of better, more efficient, more reliable valve service. He is fully equipped to assist in the solution of valve maintenance and operating problems. In addition, he can make prompt arrangements to have a Lunkenheimer Engineer call at the plant whenever technical valve engineering knowledge is required.

Good Equipment, Correctly Applied!

THAT IS THE BASIS of effective conditioning of boiler feedwater makeup . . .

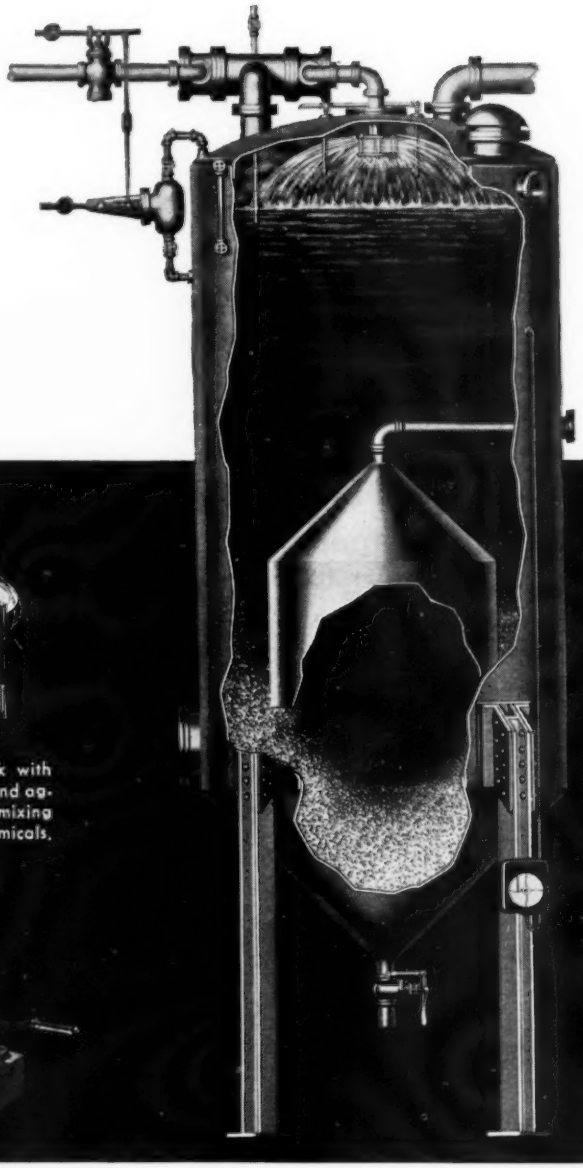
Long experience in conditioning boiler water in thousands of high and low pressure power plants qualifies Allis-Chalmers to assist you in selecting the *best* process and the *right* equipment for your plant.

Allis-Chalmers recommendations are unbiased because they provide a *complete* line of water conditioning equipment including Hot and Cold Process Softeners, Sodium and Hydrogen Zeolite Softeners, Degasifiers, Deionizers, Chemical Proportioners, and Oil Removal and Water Filters.

For prompt help, call your nearest A-C office or write: ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.

★ ★ ★

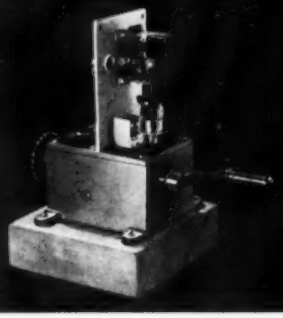
Illustrated below are component parts of Allis-Chalmers Hot Process Lime-Soda Softening System. Bulletin 28B6611 offers complete details. A 2340



FILTER TANK with water collecting and distributing system designed to insure uniform flow through graded filter bed.

CHEMICAL MIXING tank with proportioning assembly and agitator. Assures complete mixing and precise feeding of chemicals.

TEST KIT for treated water analysis and making adjustments in chemical treatment when composition of raw water varies.



ELECTRO-MAGNETIC proportioner with dust-proof cover removed. Vernier adjustment permits micro-control of chemicals fed.

SOFTENER TANK constructed to provide proper flow velocities for effective chemical reaction and sludge sedimentation.

ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment—Biggest of All in Range of Industrial Products

CHOOSE GE TURBINE DRIVE

....FOR COMPLETE SERVICE

FAST SHIPMENT

Here's good news for power-hungry plants! Delivery time on our standard (single-stage, shaft-governed) mechanical-drive turbines is down to approximately 15 weeks. Thanks to standardization and new plant facilities, shipment of standard units is better than ever before.

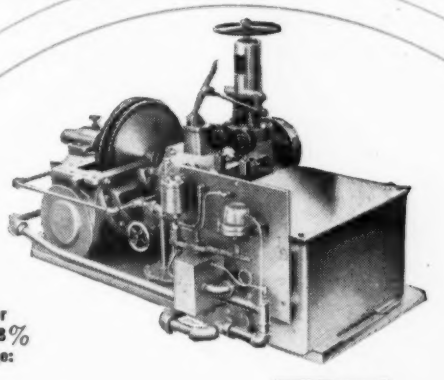
APPLICATION ASSISTANCE

G-E turbines can do a multitude of jobs—driving pumps, compressors, fans, blowers, processing machines. General Electric application engineers, backed by the experience of the world's largest turbine manufacturer, are ready to assist you in applying the *right* turbine to the *right* job.

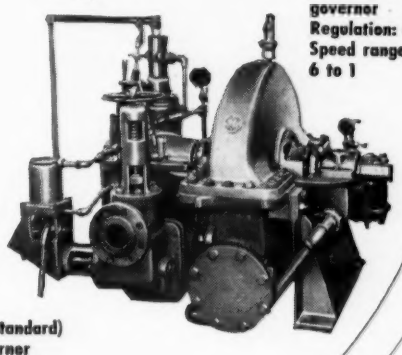
QUICK SERVICE

You can get service in a hurry when you operate G-E turbine drive. G-E maintains 26 service shops and 115 sales offices, located throughout the country. You can call on them for quick and convenient aid.

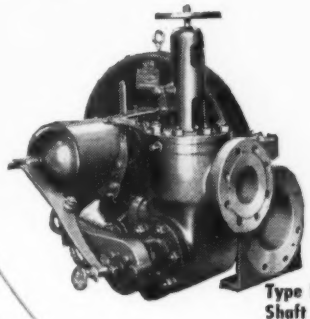
If your plant needs more horsepower, you can put G-E's complete service to work for you. Get in touch with the nearest G-E Sales Office, or write Apparatus Department, General Electric Co., Schenectady 5, N. Y.



Type DO
Oil governor
Regulation 8%
Speed Range:
5 to 1



Type DOR
Oil-relay
governor
Regulation: 4%
Speed range:
6 to 1



Type DS (standard)
Shaft governor
Regulation: 8%
Speed range: 1.1 to 1

WRITE TODAY FOR THIS NEW BULLETIN!

We'll be glad to send you the new 24-page bulletin GEA-4845, describing the features and application of Type DOR turbines. Just write General Electric Co., Dept. 252-24, Schenectady 5, New York.

A *COMPLETE* LINE

Single- and multi-stage, direct-connected and geared

GENERAL ELECTRIC 252-24

. . . but totally different at the crank shaft

Boiler feed and other high pressure services reach a new high in efficiency and a new low in cost when Worthington Triplex Power Pumps put the pressure on.

WHICH DO YOU NEED?

Whether you require the constant stroke of the VTE or the variable capacity of the Variflo, you get such efficiency-increasing, cost-lowering features as: totally enclosed power end; pressure lubrication on all bearings except the flood-lubricated main bearings; simple construction without reduction gears; patented flange and screw-type gland; full accessibility to plungers, valves and running parts. A complete range of sizes covers capacities up to 165 gpm in single units.

HOW VARIFLO DIFFERS

Worthington Variflo Triplex Power Pumps give you automatic, stepless capacity control from 0% to 100% at constant speed. The simple, rugged stroke-changing mechanism, carried in the crank shaft, is the only difference between Variflo and VTE.

Bulletins, describing how Worthington Triplex Power Pumps achieve dependable operation at minimum costs, prove that *there's more worth in Worthington*. Write for them to *Worthington Pump and Machinery Corporation, Reciprocating Pump Division, Harrison, N J.*

WORTHINGTON

P7-2

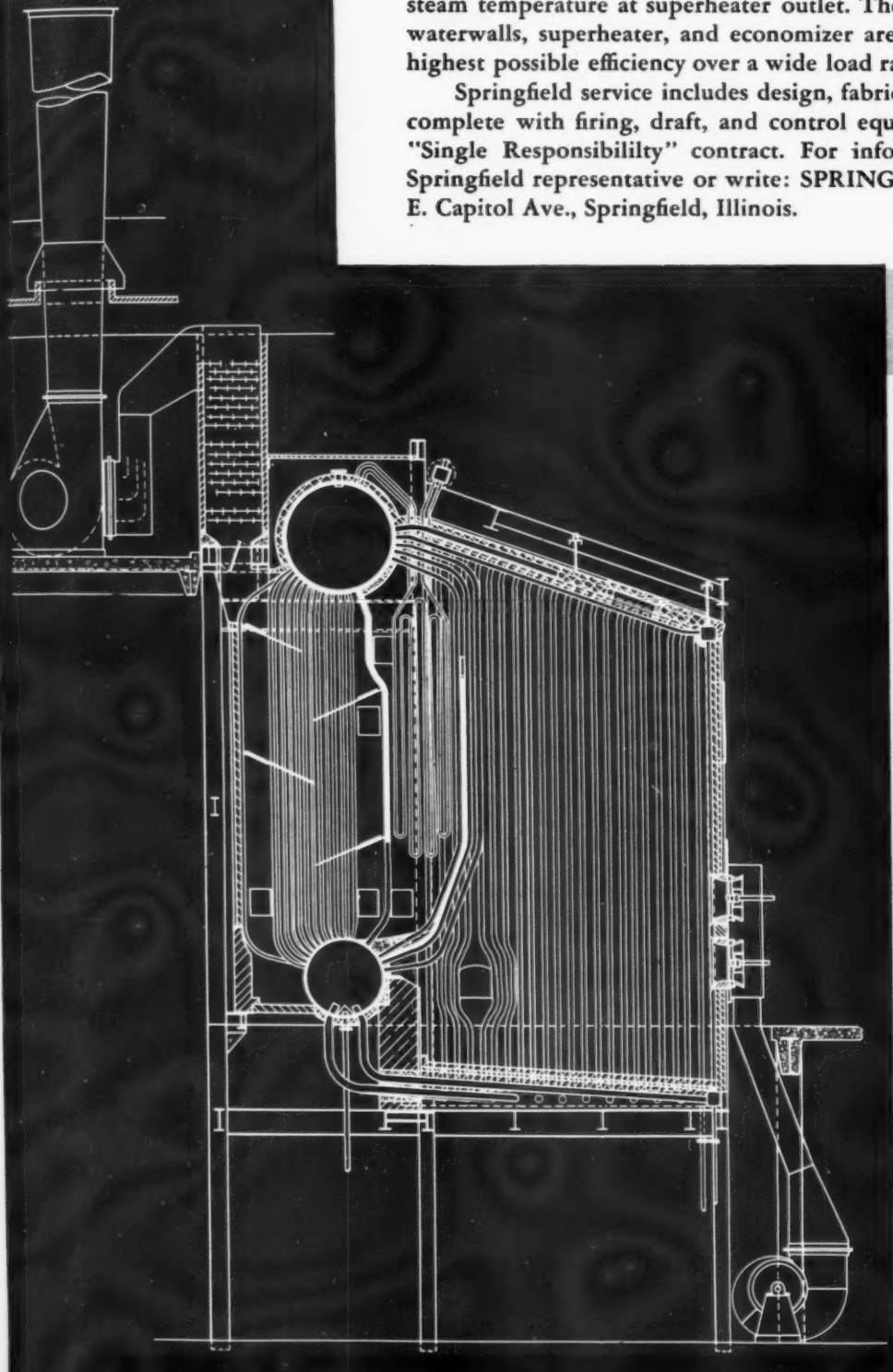
THE WORLD'S LARGEST MANUFACTURER OF PUMPS

Steam Power Rotary Vertical Turbine Centrifugal

COMPLETE STEAM GENERATOR

THIS new Springfield steam generator for municipal service in Clay Center, Kansas, is a typical example of the modern, economical units Springfield is building for power, process, and heating plant service in locations extending from the eastern seaboard to the far west. It is designed to produce 40,000 lbs. of steam per hour at 425 p.s.i. and 750° F. steam temperature at superheater outlet. The heating surfaces in boiler, waterwalls, superheater, and economizer are proportioned to maintain highest possible efficiency over a wide load range with natural gas firing.

Springfield service includes design, fabrication and erection of units complete with firing, draft, and control equipment — all taken under a "Single Responsibililty" contract. For information, see your nearest Springfield representative or write: SPRINGFIELD BOILER CO., 1953 E. Capitol Ave., Springfield, Illinois.



Location: CITY OF CLAY CENTER, Kansas. J. H. Meiers, *Plant Superintendent.*

Consulting Engineers: A. C. KIRKWOOD & ASSOCIATES, Kansas City, Mo.

WORLDWIDE SALES AND SERVICE

NEW YORK • PHILADELPHIA
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SPRINGFIELD BOILERS

SPRINGFIELD BOILER CO.

1953 E. Capitol Ave.
Springfield, Illinois

SMOOTHER HANDLING . . . BY A DAM SITE!

Another Top Performance by a BWH Product

In refacing a big Western dam to a thickness of eight feet, grout had to be forced through slotted pipes to a depth of 170 feet . . . and smooth, uniform distribution was absolutely essential.

BWH engineers unhesitatingly recommended a flexible joint of rugged BWH Grout Hose that would permit an even flow of grout from the master mixer into redistribution hoppers — even under pressure up to 500 pounds!

In addition, when redistribution hoppers that kept the lines and slotted pipes supplied with grout were full, the BWH Hose not only had to withstand the surge of pressure caused by abrupt shut-offs, but also had to route excess grout back to the master mixer.

24 hours a day, this "shaker" kept lines full, and only occasional turns of the hose were required to prevent settling of the grout.

When the job was successfully completed, this tough hose showed almost no sign of wear. The secret of its durability is an abrasive-resistant rubber inner tube and a carcass of specially woven extra-strong duck. For additional stamina, a spirally-wound band of braided, high-tensile wire is imbedded in the rubber. Tube and carcass are then encased in a strong rubber cover, able to withstand hard knocks and operating hazards.

Grout Hose is just one of the many high-quality products manufactured by BWH. Whatever your needs for industrial rubber goods, look to BWH products for dependable ruggedness—BWH distributors for dependable service!

HAVE YOU A JOB WHERE STAMINA COUNTS?

Bring us your toughest problems . . . we're specialists in solving them. Consult your nearby BWH distributor, or write us direct.

Another Quality Product of

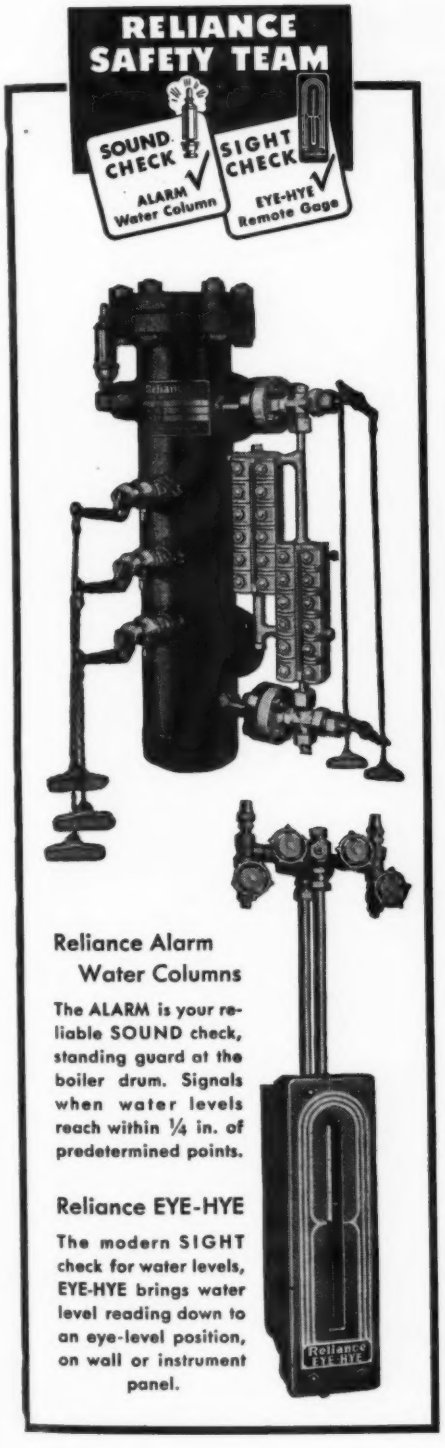
BOSTON WOVEN HOSE & RUBBER COMPANY

Distributors in all principal cities

PLANT: CAMBRIDGE, MASS., U.S.A. • P.O. BOX 1071, BOSTON 3, MASS.

This team works for thousands of power plants like yours

Double checks boiler water levels—helps you achieve more efficient operation, lower power cost, greater safety



Reliance Alarm Water Columns

The ALARM is your reliable SOUND check, standing guard at the boiler drum. Signals when water levels reach within ¼ in. of predetermined points.

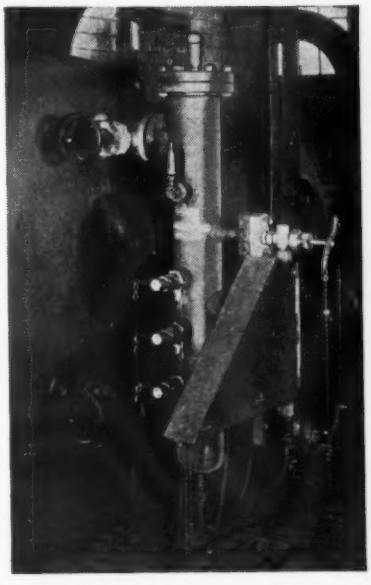
Reliance EYE-HYE

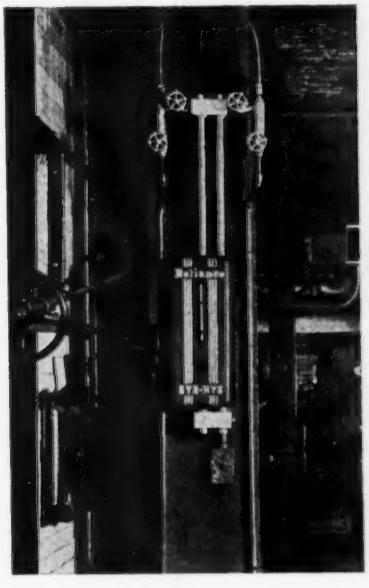
The modern SIGHT check for water levels, EYE-HYE brings water level reading down to an eye-level position, on wall or instrument panel.

OF ALL THE FACTORS requiring constant careful checking in your power plant, the boiler water level remains one of the most important. In spite of careful employee training and frequent warnings, low water level is still a common cause of serious boiler damage. The Reliance Safety Team has been on the job for years in many plants . . . supplying a reliable double check to prevent accidents and costly boiler outage.

Up on the boiler drum the Reliance ALARM sounds instant warning when levels go too low—or too high—by shrill whistle or by electric signals. EYE-HYE carries the true water level reading, in brilliantly illuminated green indication, to convenient positions on the boiler room floor or remote control panel. It's read at a glance, saves time, induces frequent checking.

Don't take chances on power failure when Reliance Safety Team gives you the means of adequate water level supervision. And better supervision helps you to keep fuel costs down, gives you more capacity through consistent operation. Write for ALARM and EYE-HYE bulletins—there's no obligation, of course!





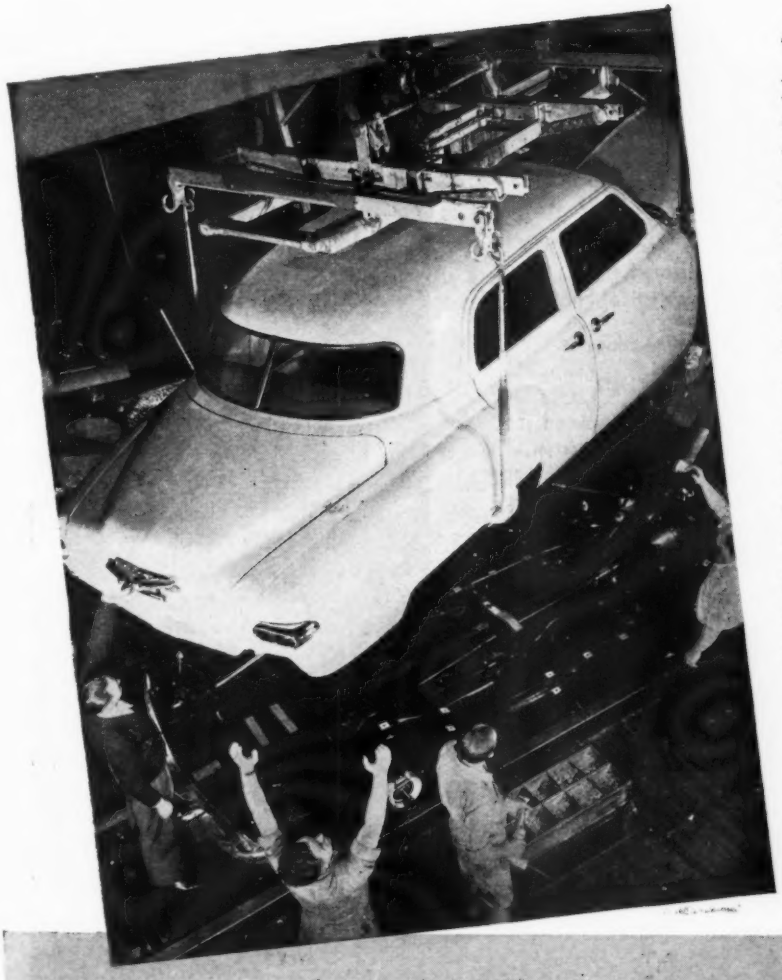
BOILER SAFETY DEVICES since 1884

Reliance

THE RELIANCE GAUGE COLUMN CO. • 5902 CARNEGIE AVENUE • CLEVELAND 3, OHIO

1st
2nd
3rd

FW UNIT FOR STUDEBAKER



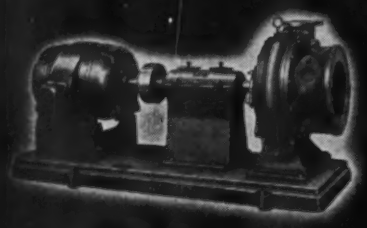
To meet the unprecedented demand for post-war automobiles, reliable and efficient steam generation is a "must" at The Studebaker Corporation's South Bend, Indiana plant. When plant expansion necessitated additional steam capacity, a third steam generating unit, a duplicate of the first two, was ordered from Foster Wheeler.

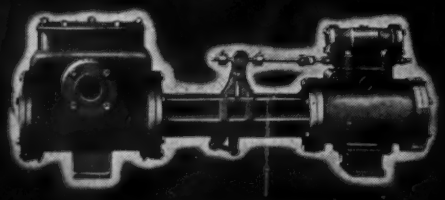
Regardless of finished product, whether automobiles, typewriters or electric power, a reliable and efficient source of steam is assured by Foster Wheeler steam generators. They are backed by years of experience in producing successful designs over the complete range of sizes.

FOSTER WHEELER CORPORATION
165 BROADWAY • NEW YORK 6, N. Y.

FOSTER WHEELER CORPORATION

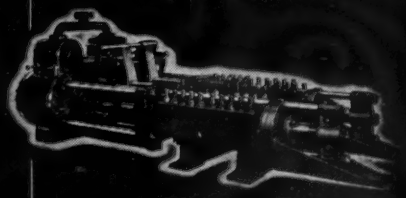
Warren Stock Pump
Type 5-SOD-15 . . . 12" suction nozzle





Warren Steam Heat
Vacuum Pump

Warren Horizontal Duplex
Hydraulic Pump



WARREN PUMPS

Maintain efficiency
Operate at low cost
Are long-lived

CENTRIFUGAL

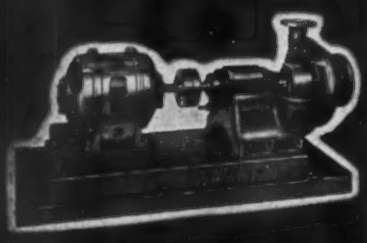
Single and multi-stage
Pressure range: 0 to 1200 P. S. I.
Capacities: 0 to 50,000 G. P. M.
Types: Horizontal and Vertical
Impellers: Open or enclosed
Casings: Horizontal or Vertical Split, cast iron or bronze
Bearings: Sleeve or ball-bearing

RECIPROCATING

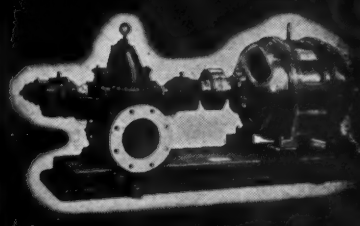
Horizontal and Vertical single piston
Horizontal and Vertical duplex piston
Single and Duplex Outside Packed Plunger
Single, Duplex and Compound Hydraulic
Steam Heat Vacuum
Automatic Pump and Receiver, etc., etc.,

Send your pumping problem to us, our Engineers will recommend the right pump for the job.

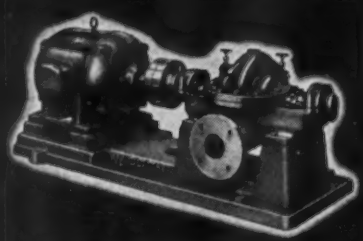
P 14



Warren Type "L" Single-Stage
Single-Suction Liquor Pump



Warren Double Suction Pump
Single Stage



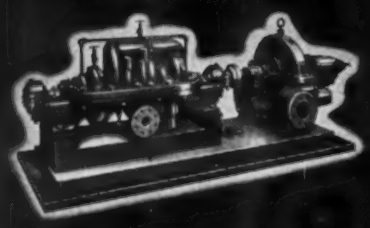
Warren Type DBL, Single-Stage
Double Suction, Centrifugal Pump

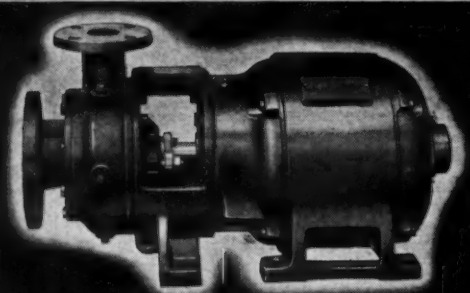
Warren Two-Stage Volute
Centrifugal Pump

WARREN STEAM PUMP COMPANY, INC.

WARREN, MASSACHUSETTS

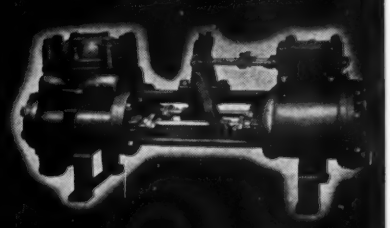
Warren Type TM, 4 and 6 Stage
Centrifugal Pump

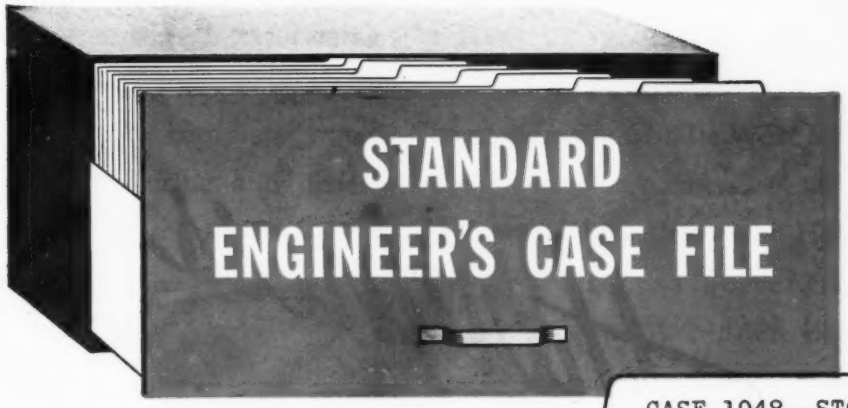




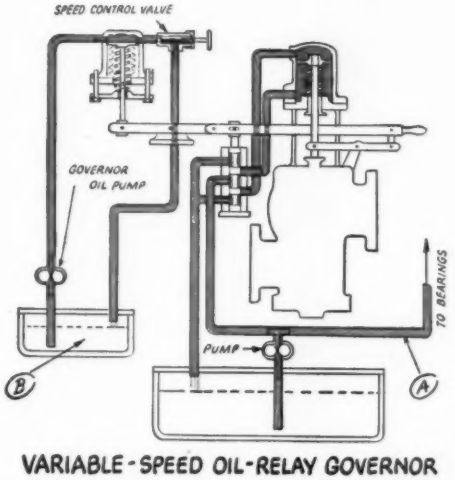
Warren "Compacunit"—4 Types—42 Sizes

Warren Horizontal "Realwear"
Duplex Piston Pump





CASE 1048—STOPPING RUSTING, LACQUERING, SLUDGING IN STEAM TURBINES.



VARIABLE-SPEED OIL-RELAY GOVERNOR

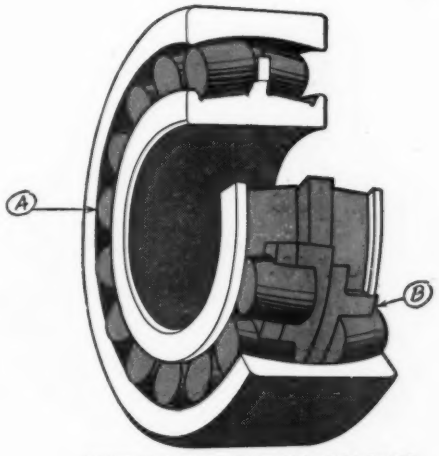
Charges of inhibited Calol OC Turbine oil in various size turbines gave service many times longer than normally obtained with straight-mineral oils. Use in large and small units ... ring-oilers, circulating oil lubricating systems and oil-actuated governor relay systems. Comes in five grades: 5, 9, 11, 15, 19.

A. Contains highly effective corrosion inhibitor and has excellent metal-wetting ability. Keeps moisture in oil systems from contacting metal.

B. Oxidation inhibitor resists deterioration of oil and sludge formation caused by heat, moisture, air, dirt ... prevents plugging of oil lines.

Calol OC Turbine Oil in regular service showed no increase in acidity after several years ... turbine parts remained in same condition as when installed ... water and solid contaminants separated readily from oil in centrifuging or filtering systems.

CASE 1050--PROVIDING FLUID LUBRICATION IN ANTI-FRICTION BEARINGS WITHOUT LEAKAGE.



HEAVY-DUTY ROLLER BEARING

Heavy-duty industrial roller bearings started easier and ran freer when lubricated with Calol Grease BRB-340. Specially-made for all anti-friction bearings. Apply with grease gun or by packing.

Has unusual ability - softens around roller and balls in bearings to oil-like viscosity but remains firm on outer parts. Resets quickly so oil swept aside by moving bearing parts keeps firm outer seal of grease intact.

A. Soft consistency around moving parts of bearings lowers starting torque and reduces internal friction.

B. Firm grease forms seal that helps prevent leakage.

High resistance to deterioration under high speed conditions and extreme temperatures provides exceptional lubrication over extended periods of operation.

For additional information and the name of your nearest Distributor, write

STANDARD OIL COMPANY OF CALIFORNIA

225 Bush Street, San Francisco 20, California

The California Oil Company
30 Rockefeller Plaza, New York 20, N.Y.

The California Company
17th and Stout Streets, Denver 1, Colo.

Standard Oil Company of Texas
El Paso, Texas

RPM CALOL

Trademarks Reg. U. S. Pat. Office

Zero Hardness Oxygen

MEANS
CORROSION-FREE
BOILER PLANT EQUIPMENT

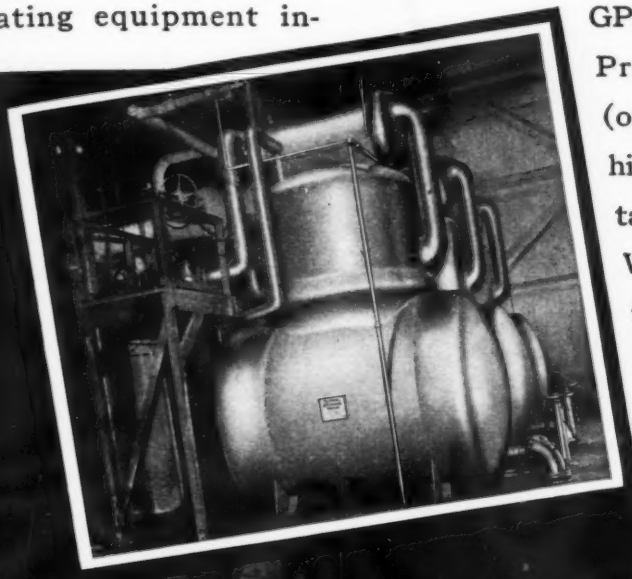
That's where Cochrane Water Conditioning Engineering and Equipment come in . . . to protect from scale and corrosion, the piping, boiler tubes, economizers, etc., of the boiler plants of the world . . . a job they've been doing for 85 years.

COCHRANE

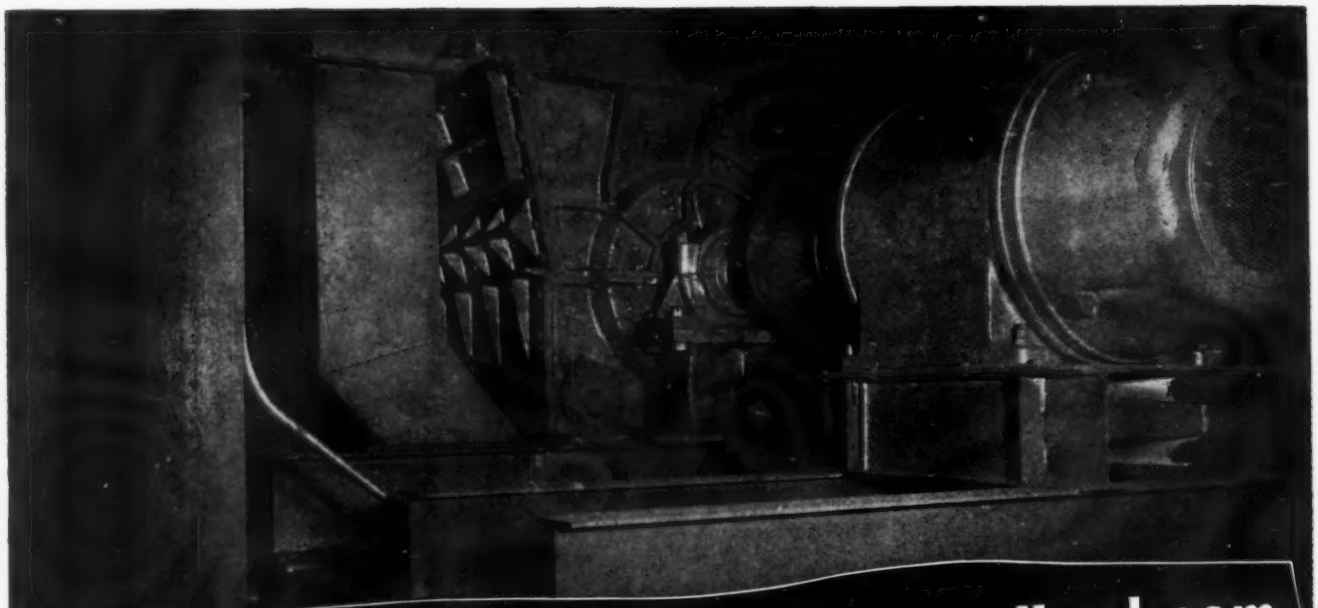
GUARDIAN OF STEAM HORSEPOWER

COCHRANE CORPORATION, 3106 N. 17TH STREET, PHILADELPHIA 32, PA.

This installation is interesting in that it shows in practically one view the complete water softening, filtering and deaerating equipment installed to protect the boiler plant of a large steel company located in the Middle West. At the left may be seen two 24,000 GPH Cochrane Hot Process Softeners (one is hidden behind sedimentation tank in foreground). Water supplied to the power plant boilers is drawn from Lake Michigan in a raw state with a hardness of 138 ppm, chiefly bi-carbonates, and with an alkalinity of approximately 106 ppm. The Cochrane unit processes this raw water to zero hardness. The water is first treated with lime and soda ash, after which it passes directly to the second stage in which the effluent from the lime and soda tanks is treated with phosphate chemicals and after settling, the water is filtered through three 8 ft. Cochrane Non-Silite Filters. The softened water and the condensate are deaerated in three Cochrane Deaerating Heaters each of 242,460 lb./hr. capacity. (see small photo inset)



COCHRANE CORPORATION, 3106 N. 17TH STREET, PHILADELPHIA 32, PA.



AMERICANS – High Tonnage in Low Headroom

A COMPLETE CRUSHING OPERATION WITHOUT EXTRA PICKING OR STANDBY-CLEANOUT LABOR REQUIRED

The compactness of design and construction of American Type "S" Rolling Ring Crushers make for a complete, high tonnage installation with minimum headroom requirements. ROM coal is rapidly reduced to uniform screenings of stoker or pulverizer sizes. American are particularly well adapted to installation in existing plants without the necessity of extensive alterations.

No auxiliary crushing operations and equipment are necessary to the high performance of Americans—no extra picking and standby-cleanout labor is required.

Americans create no refuse problem. Slates and pyrites are processed and tramp iron rejected. Americans are made in capacities to fit your operation—from 25 to 500 TPH.

American's exclusive manganese steel shredder ring and rotor assembly. The high tonnage output of Americans at slow, power-saving speeds is attained by the rapid reducing action of the multiple cutting edges of the many rows of rings on the heavy rotor. Each ring revolves on an individual shaft, free to deflect without damage from tramp iron. The crushing chamber of Americans is made up of sectional manganese steel liners. Housings are of heavy ribbed steel castings secured at dust-tight machined joints with coupling bolts for easy access to all crushing parts.

Send for bulletin "Crushing Coal At Less Than 1c Per Ton"

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

1349 Macklind Ave.
St. Louis 10, Mo.

to keep sludge down

KEEP DIRT and WATER OUT!

De Laval Oil Purifiers are furnished in a wide range of capacities, enabling every operator to obtain the machine best suited to his turbine.

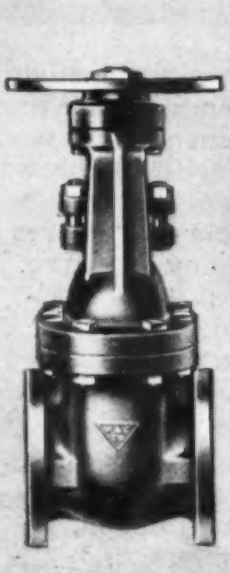
De Laval Oil Purifiers keep turbine lubricating oil in best possible condition, for they remove ***both*** of the contaminants that tend to form sludge. Centrifugal force throws out any dirt or solid impurities that may be present, and—equally important—removes and continuously discharges any moisture. Thus oil maintained by De Laval Oil Purifiers is constantly cleaned and dehydrated, and the lubricant returning to the turbine reservoir is like brand new oil.

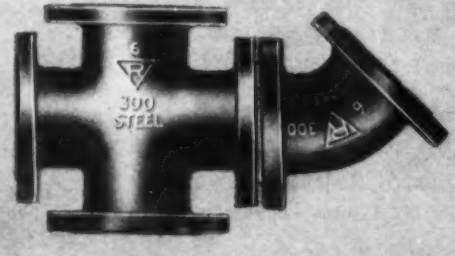
De Laval protection costs only a scant fraction of the price of a single failure due to improperly maintained lubricants. And the Purifier itself costs very little to use, day in, day out. Supervision is at a minimum and mechanical trouble so rare as to be all but eliminated from the engineer's thinking. About all that is necessary is the periodic removal of dirt from the bowl.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

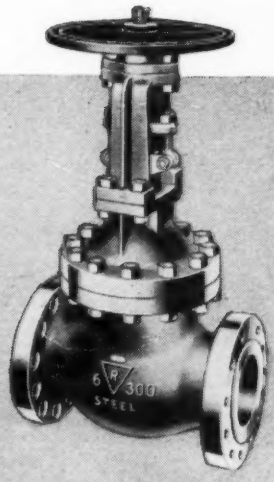
DE LAVAL
Lubricating Oil Purifiers

"VALVE MEN" LIKE R-P&C VALVES

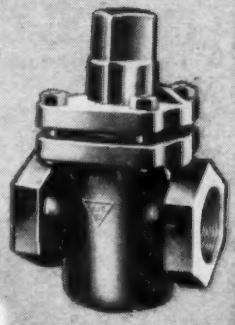




Men who really know valves— know where to look for those details of design and construction that insure top performance—have a lot of respect for Reading-Pratt & Cady.



An R-P & C valve must be more than just an assembly of machined parts. It has work to do. R-P & C feels the responsibility for that work being done faithfully.



Consider your R-P & C distributor as your "valve man"—a responsible source for bronze, iron and steel gate, globe, angle and check valves—Bar Stock valves—iron cocks—Lubrotite gate valves—cast steel fittings.

ACCO

Reading, Pa. • Atlanta • Baltimore • Boston • Chicago • Denver • Detroit • Houston • Los Angeles • New York • Philadelphia • Pittsburgh • Portland, Ore. • San Francisco • Bridgeport, Conn.

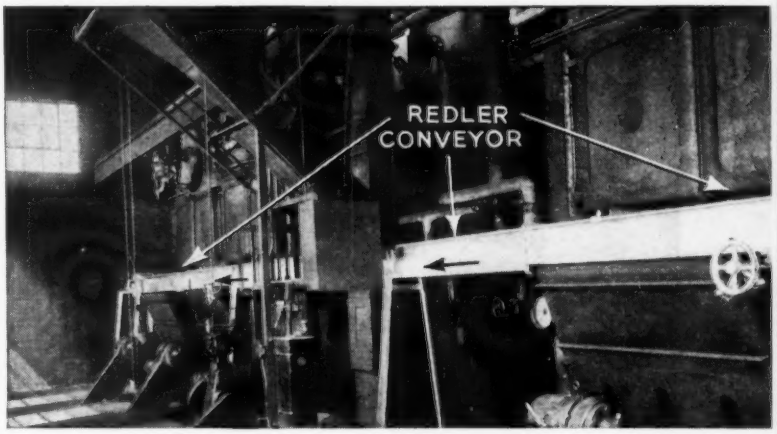
READING-PRATT & CADY DIVISION
AMERICAN CHAIN & CABLE

TRADE MARK

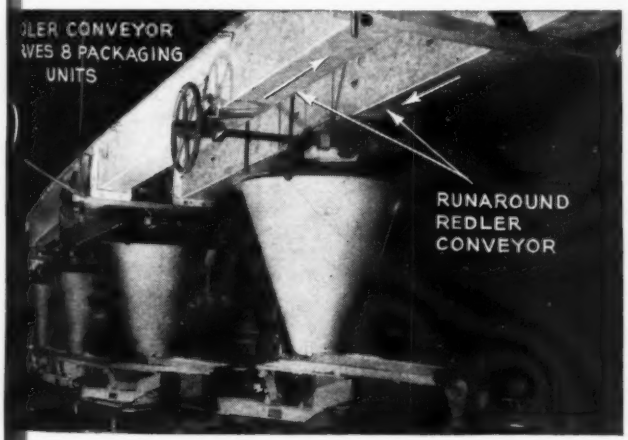
READING-PRATT & CADY

Do you see the answer to your bulk material handling problem here?

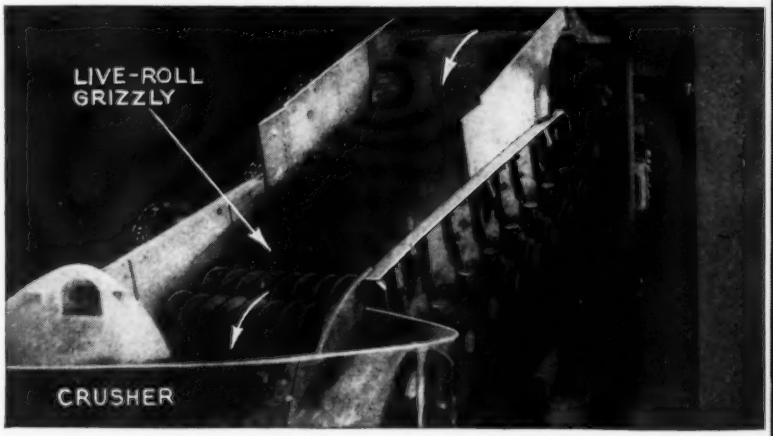
One of hundreds of Stephens-Adamson engineered coal conveyor systems. This one has unloaded, stored, screened and delivered 300,000 tons of coal a year since 1926 with practically no repairs. Similar systems are cutting costs of handling aggregate, ore and other bulk materials. Each system is specially engineered for the job—easy for S-A because S-A makes all types of conveying equipment and accessories—S-A can use the exact type of equipment the job requires.



Feeding coal to boiler hoppers is a job made-to-order for an S-A engineered REDLER Conveyor System. Sealed casings eliminate coal dust. Inherently compact, REDLER systems save space, reduce need for bulky equipment. They move bulk materials fast in a solid mass horizontally, up, down, around corners, anywhere. A perfect example of low-cost handling with the right equipment engineered into the right system.



When absolute cleanliness without disturbance of balance of mixed ingredients is needed, S-A REDLER Conveyor-elevator Systems get the call. The system shown here conveys food ingredients, distributes the mixture to battery of packaging machines. Sealed casings prevent contamination, eliminate waste from spillage. S-A engineered REDLER Systems are in wide use in the food processing and chemical fields . . . can be engineered to meet virtually any bulk material handling problem.



Special handling problems are readily solved by S-A engineers with their unlimited access to the right equipment, all built by S-A. Here you see an S-A Live Roll Grizzly used to feed large lumps of ore to crusher, while passing fines through to belt conveyor below. What's your handling problem? Difficult? Involved? Talk it over with S-A engineers. Let them show you how the right equipment, engineered into the right system can provide the efficient, economical answer.

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BULK MATERIAL HANDLING EQUIPMENT

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Permitting speed variations from 15 to 25% *Vari-Pitch* sheaves make it easy to change machinery speeds.

Built in sizes to fit all standard motors up to 300 horsepower, these sheaves are an Allis-Chalmers product...with bodies of Nickel alloy cast iron to assure long, low-cost performance.

The dense grain and high machinable hardness of this Nickel cast iron aids in the production of long wearing sheaves that maintain their efficiency over long periods of service.

Ask us for information about the advantages Nickel alloyed irons provide for specific applications.

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Over the years, International Nickel has accumulated a fund of useful information on the selection, fabrication, treatment and performance of engineering alloy steels, stainless steels, cast irons, brasses, bronzes and other alloys containing Nickel. This information is yours for the asking. Write for "List A" of available publications.

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Day in and out, for twenty-four years this Sarco TR-21 Temperature Regulator has controlled the temperature on this large hot water tank in a Cleveland plastics plant.

Because the water for washing and processes has always been "ready to use", oceans of water have been saved during this period. Since the temperature was never too high, car loads of coal were never burned. And in the plant the water for every process was just right, saving thousands of dollars in rejects and building up a life time reputation for the consistent quality of this company's products.

And all this for less than a cent a day — for that is the original cost of the Sarco Control divided by its many days of faithful service. Many Sarco Controls are so inexpensive and effective that their cost is paid for in savings in a few months.

Other Sarco Controls for room temperatures, processes, cooling water and refrigerants are also available.

This Sarco Control operates steam, water, brine and gas valves ½ to 8 in. Entirely self-contained and self-operated. No electricity, compressed air, etc., needed. Easy to install. For any temperature between 0 and 300° F. Write for Catalog No. 600.

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6 Campaigns without a shutdown!

THE Spreckels Sugar Company of San Francisco operates a white sugar centrifugal drive which used to tear the life out of belts. The best quality "double" belts stretched, burned, separated at the plies — often caused expensive shutdowns in the midst of campaigns. Then the G.T.M. — Goodyear Technical Man — recommended a Goodyear COMPASS "80" endless belt. The COMPASS has done heavy duty for six campaigns without trouble of any kind, without a single shutdown. It's one more proof that Goodyear Industrial Rubber Products — Hose, Belting, Molded Goods and Packing — *are Highest in Quality, Lowest in Ultimate Cost.*

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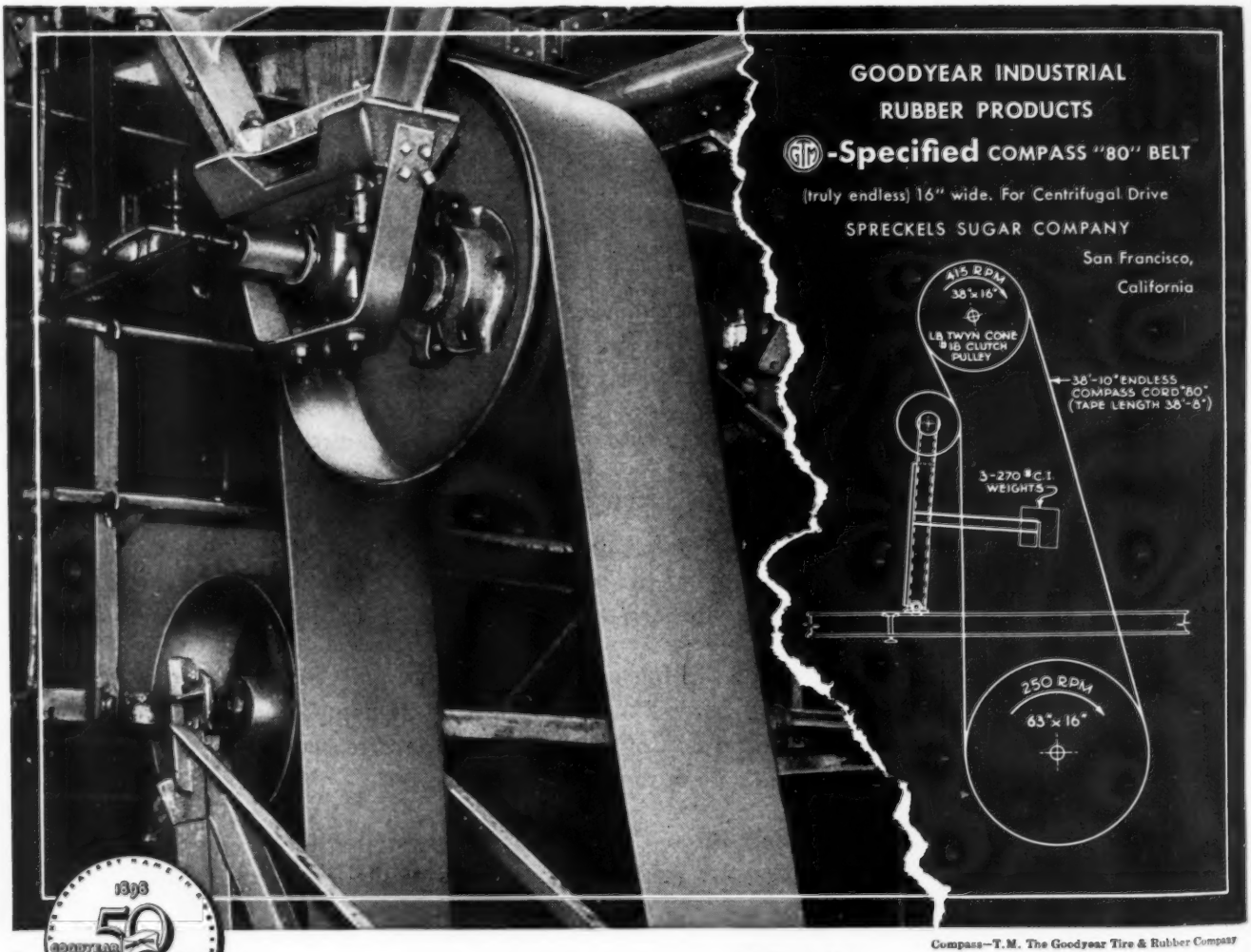
TO ORDER: Phone your nearest Goodyear Industrial Rubber Products Distributor — or write the G.T.M., Akron 16, Ohio or Los Angeles 54, California.



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Compass—T.M. The Goodyear Tire & Rubber Company

GOODYEAR

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Is THIS the pump you need?

THE *Electrifugal* PUMP

IT'S COMPACT Pump and motor are combined in one rigid cast iron frame. Fits easily into close quarters—is quickly installed as a "package," and operates in any position—no shafts to align. Just bolt it down, make power and pipe connections, and start pumping. Capacities 15 to 1400 gpm, heads to 500 ft.

IT'S EFFICIENT Drip-proof motor is of Allis-Chalmers Lo-Maintenance design, specially built for pumping service. Pump has such long-service features as bronze wearing rings, new plastic water seal, five or more rings of packing, and first class construction throughout. Every unit is factory tested for efficiency, capacity and head.

IT'S AVAILABLE Many sizes of the Electrifugal and other smaller Allis-Chalmers pumps are now in stock for immediate delivery. Perhaps the size you need is ready. Phone or wire your nearest Allis-Chalmers office or dealer for up-to-the-minute information on availabilities and deliveries. For information on the complete A-C line of centrifugal pumps, ask for Bulletin B6059D. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN. A 2381

PEDRIFUGAL
The new A-C pump for flexible Texrope V-belt drive. Capacities to 500 gpm, heads to 100 ft.

SS UNIT
Close-coupled pump and motor units, made in 234 standard ratings, to 2500 gpm.

Electrifugal, Pedrifugal, SS Unit and Texrope are Allis-Chalmers Trademarks.

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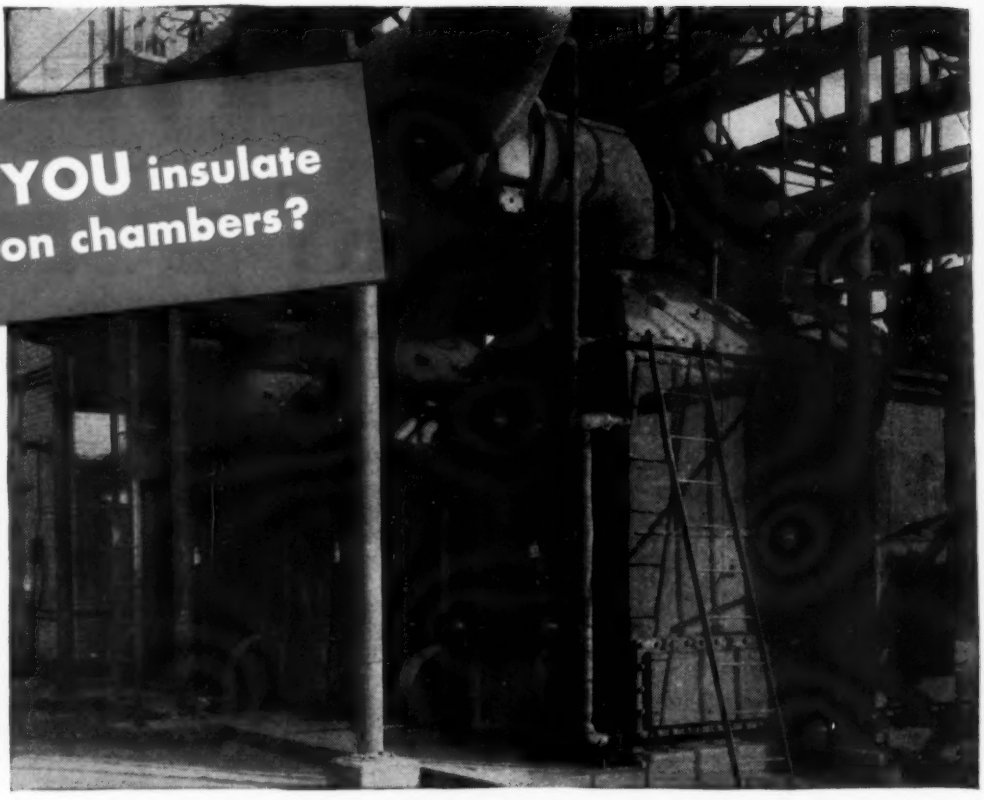
One of the Big 3 in Electric Power Equipment—Biggest of All in Range of Industrial Products

How would YOU insulate these reaction chambers?



HERE'S THE PROBLEM: Outdoor processing vessels are in two sections. The upper must be held between 68° and 70° F., the lower above 212° F. Which insulation material or materials should be used?

☐ 2" of 85% Magnesia over entire vessel.

☐ 2" of 85% Magnesia on lower section, 2" of corkboard on upper section.

To remove gum compounds by electrical precipitation, manufactured gas is piped through the top sections of these boxes at a rate of 1 million cubic feet per hour.

The efficient operation of this equipment depends primarily upon holding the temperature of the gas between 68–70°. Above 70° the proper reaction does not take place and the removal of gum compounds may be retarded. Gas enters at 68° F., and if its temperature drops, moisture condenses, drips down, and cracks large glass insulators in the lower section of the boxes, short-circuiting the entire system. Steam coils heat this lower compartment to above 212° F. to protect the glass insulators against moisture.

What specification would you use to insulate these vessels?

HERE'S WHAT THE ARMSTRONG ENGINEER RECOMMENDED: Insulating the upper part of the equipment could be effectively accomplished with 2" of 85% Magnesia. The real problem, however, is in insulating the upper portion of the boxes against the critical two-degree temperature change.

In the range below 75° F., corkboard is a better insulator than magnesia. Therefore, the second method—using Armstrong's Corkboard on the upper section, with magnesia on the lower portion of the boxes—is recommended.

There's a positive advantage to you in the fact that Armstrong engineers are thoroughly familiar with low-temperature as well as high-temperature insulation work. A surprising number of jobs require both types of insulation.

When you call Armstrong's Contract Service for insulation advice, you don't need to divide up the work or the responsibility. You can simplify your whole procurement setup by dealing with this one dependable source of supply. It covers engineering over the entire range of processing temperatures from 300° below zero to 2800° F., supply of materials for that complete range, and provision of workmen to install these insulations properly.

FREE INSULATION CHART

This chart lists types and thicknesses of insulation for temperatures from 300° below zero to 2800° F. Write today to Armstrong Cork Co., Industrial Insulation Department, 7002 Maple Ave., Lancaster, Pennsylvania.

ARMSTRONG'S INDUSTRIAL INSULATION

Complete Contract Service For All Temperatures

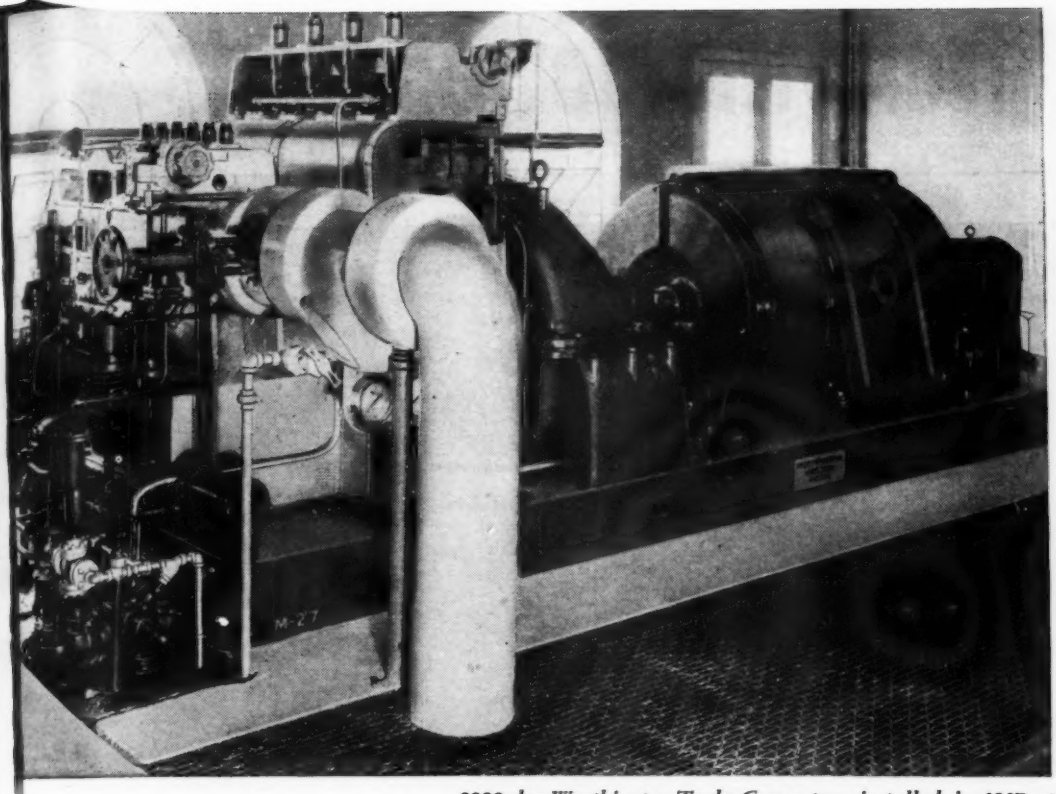
From 300° Below Zero

To 2800° Fahrenheit

NEWS

FROM THE POWER FRONT

AS REPORTED BY THE DEVELOPMENT ENGINEERS FIELD SERVICE REPRESENTATIVES AND CUSTOMERS OF WORTHINGTON



2000 kw Worthington Turbo-Generator—installed in 1937 at Detroit Lakes, Minnesota, power station.

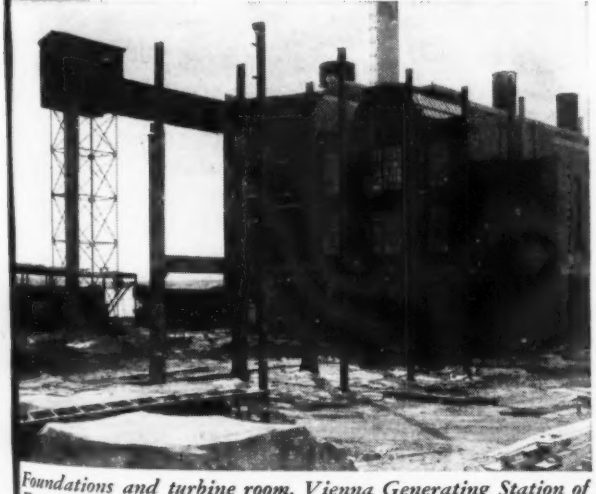
4000 kw More For Detroit Lakes

The City of Detroit Lakes, a bustling Minnesota resort center, has long taken pride in its municipally owned power plant. Through careful planning and good management, the plant has prospered . . . and the utilization of extracted steam from the generator units for heating the business district and public buildings is an advantage in Northern Minnesota measured beyond dollars and cents!

Detroit Lakes' order for a Worthington 4000 kw automatic bleeder turbine will bring to 7000 kw its total of Worthington installed turbine power. The first Worthington turbine, a 1000 kw unit, was installed in 1933; the second, a 2000 kw unit, in 1937.

The units have been inspected every two years and have been reliable and economical in operation.

Del-Mar-Va's Vienna Station Expands by Six Million



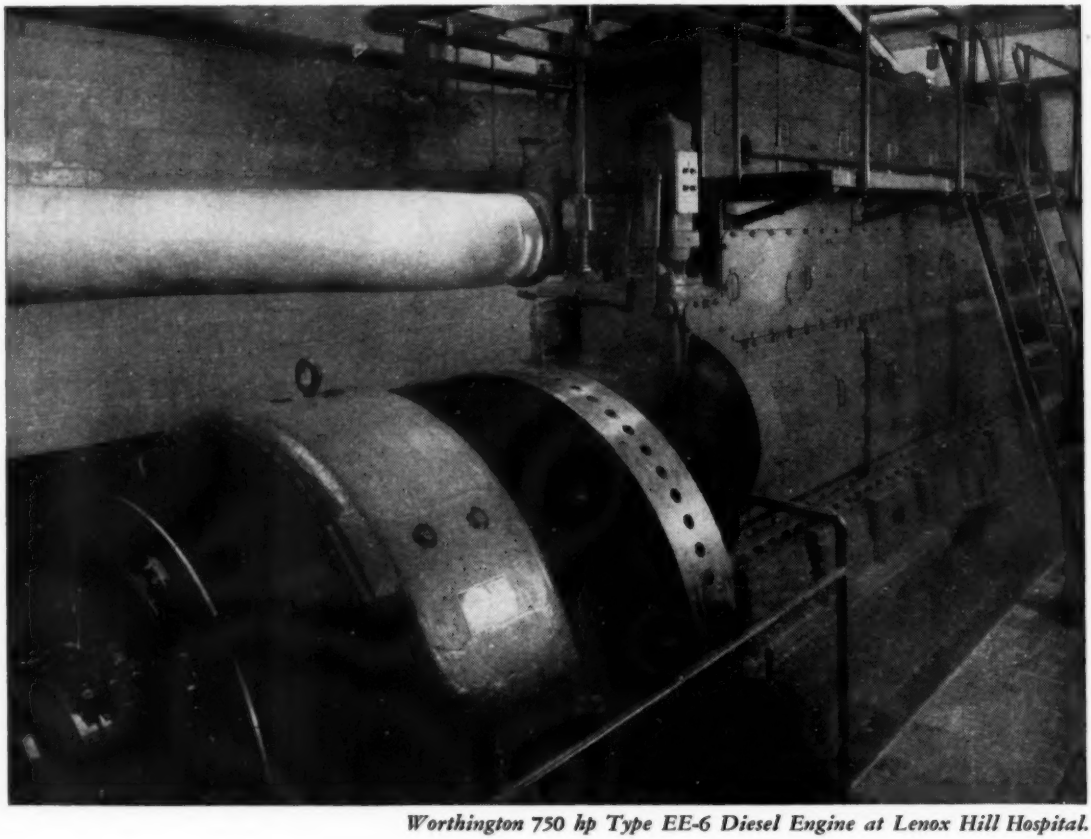
Foundations and turbine room, Vienna Generating Station of Eastern Shore Public Service Company of Maryland (United Engineers & Constructors, Inc., Philadelphia).

To provide more electrical energy to the Del-Mar-Va Peninsula, the Eastern Shore Public Service Company, a subsidiary of the Delaware Power and Light Company, is now undertaking a $6,000,000 expansion of its station in Vienna, Maryland.

Worthington was recently awarded the contract for the condensing unit to serve the latest 15,000 kw Turbo-Generator: a 14,000 sq-ft two-pass condenser with auxiliary equipment.

Four units are now in operation in this station—two 6,000 kw and two 7,500 kw. One 15,000 kw unit is being installed by the United Engineers and Constructors and a similar unit is on order. The two 6,000 kw generators operate at 300 psi, 675F, TT; the 7,500 kw and 15,000 kw units operate at 650 psi, 825F, TT.

NEWS from the power front



Worthington 750 hp Type EE-6 Diesel Engine at Lenox Hill Hospital.

Worthington Diesel at Lenox Hill Hospital

A 750 hp Type EE-6 Worthington Diesel engine installed in the power plant of Lenox Hill Hospital in New York City has helped to produce substantial savings in the cost of producing power during each operating month as compared with the previous steam engine installation.

Prior to the installation of the Diesel generating unit, power was furnished for 20 hours per day by a 400 kw steam engine generator unit, and during the balance of the day small steam engine generating units of 75 and 125 kw carried the load. With this arrangement, opportunity for adequate maintenance of the large engine unit was extremely limited. Then, too, during the warm weather months when demand for exhaust steam was at a minimum, a large amount of steam was wasted.

The new Diesel unit is the perfect answer to both these problems, being available at any time as standby for the large steam unit and eliminating the waste of exhaust steam during the warm months when it runs continuously.

The Diesel is a 6 cylinder, four cycle engine having 16 in. bore and 20 in. stroke. The starting air is supplied at 250 psi by a Worthington two-stage compressor. Jacket water, raw water and waste heat boiler feed pumps were all supplied by Worthington.

Million Dollar Baby

Installation of Model C Worthington Allspeed Selectors, at The Floyd A. Holes Co. plant in Bedford, Ohio, finally brought a well-deserved lay-off to a Model A Allspeed Selector purchased during the early part of the war.

It was originally put to work on a laminating machine making Grade C Type I ordnance wrap. The machine was then equipped with a ¾ hp motor. For a long time, the equipment was operated as hard as possible—from high speed to low speed about every 1½ minutes for 24 hours a day, seven days a week.

Then a 1 hp motor was installed —and later, a 2 hp motor. Finally, the drive—not intended for such heavy service—began to falter and was replaced with the larger Selector.

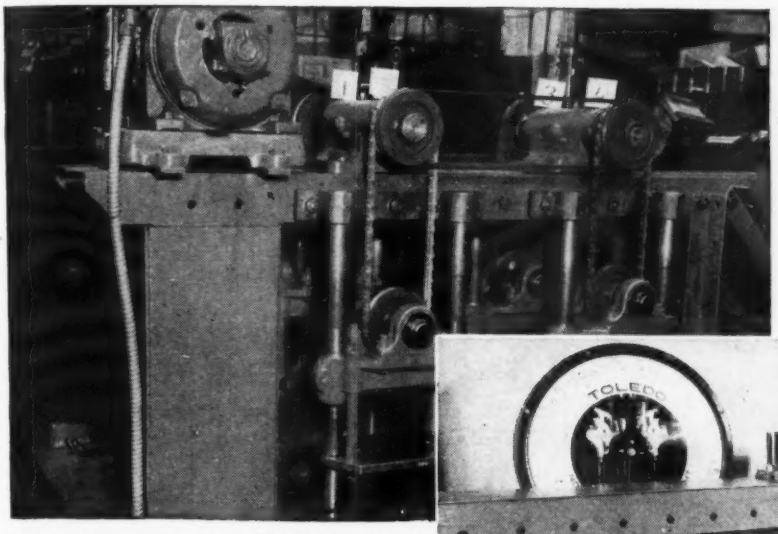
Mr. F. A. Holes reports:

"That little drive produced over a million dollars worth of Grade C Type I before we finally removed it from that operation. Since that time, we have placed it on several smaller operations, and we want you to know that it is still working perfectly today whenever we have occasion to use it. We believe that this is indeed a complimentary record for this piece of equipment and felt that you would like to know about it."

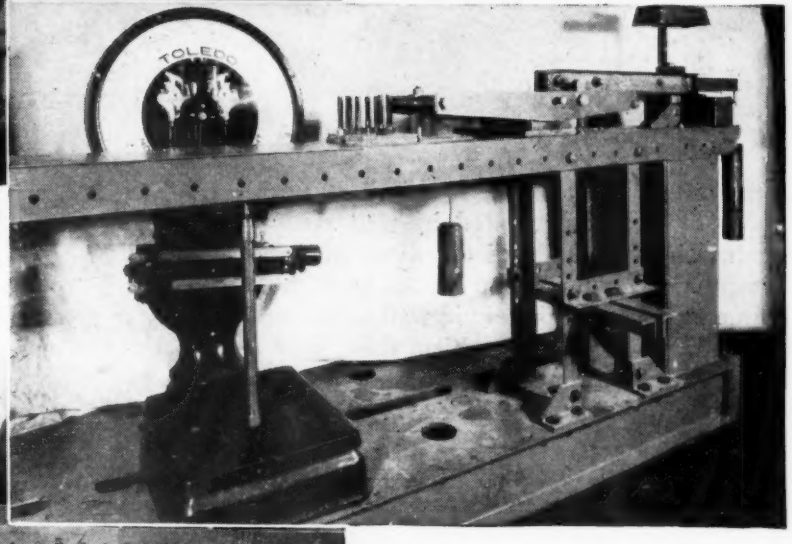
Worthington Pump and Machinery Corporation
Harrison, N. J.

NEWS

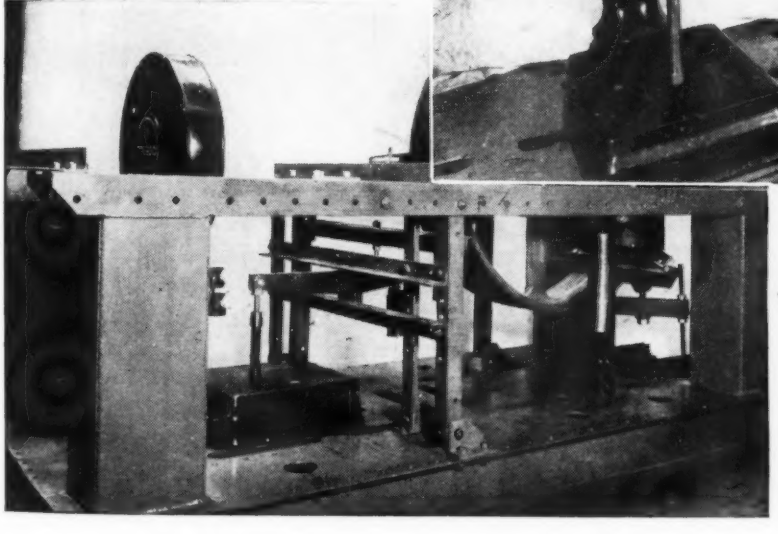
Universal Test Stand for Worthington Multi-V-Drives



Typical set-up of fixtures for comparative testing of Vee Belts to determine flex life and endurance under various speeds and loads. Photos taken in Worthington's Multi-V-Drive Research and Development Engineering Dept.



This fixture tests various kinds of steel and heat treatment on QD sheave hub pull-up bolts for wrench torque, elongation, elastic limit, ultimate strength and distortion in the thread lead relative to pulling power of bolt.



Static torque testing apparatus with rating up to 200,000 inch pounds torque determines cone grip capacity of QD sheaves and hubs. It permits mechanical or electric detection of cone slip in minute proportions.

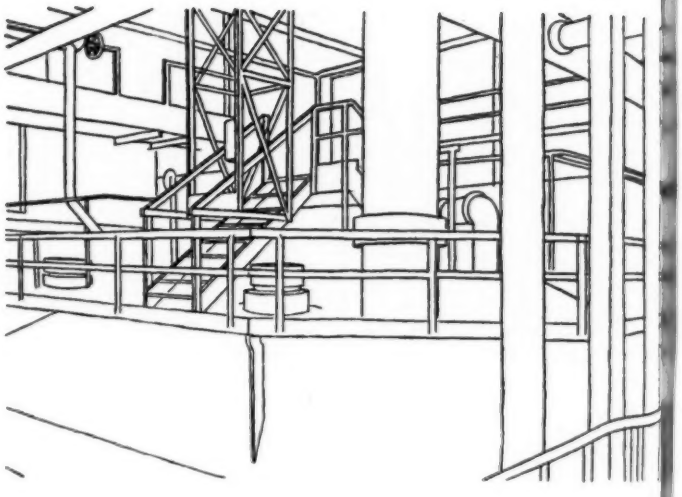
It's a Long Drink from Arkansas to Chicago

Mountain Valley Water Company supplies bottled water to thirsty Chicagoans, all the way from Hot Springs, Arkansas. Until this past summer, the water had been shipped in 30-gallon drums. Unloading these drums from freight cars at the Chicago end took four men about five hours per freight car load of 5500 gallons.

Last May two 8000-gallon tank cars were leased. When the water arrives in Chicago, the tank is hooked up with a Worthington Monobloc Centrifugal pump in the basement of the bottling plant, and within two hours, the water has all been transferred to stainless steel storage tanks on the fourth floor of the building. Labor cost involved is just for starting and stopping the pump motor.

The pump is 3 hp, 3600 rpm, with a 3-phase, 220/440 volt drip-proof motor.

What determines



ONE of the more simple problems in boiler water pre-treatment is that presented by well water which contains large amounts of dissolved carbon dioxide, temporary hardness and silica, plus the other constituents normally present in well water.

Even this apparently simple problem may, however, be complicated by many factors. Softening is obviously required, but should it be by hot process, base exchange, cold sludge contact, or some combination of these methods? In part the answer will depend on the pressure of the boilers, the ratings at which they are to be operated, and the ways in which the steam is to be used. In part it may depend on other factors, some of which may be common to many plants, while others may be conditions peculiar to a single plant.

In one plant, for example, most factors pointed toward the use of a hot process softener—but the treating plant had to be located some distance from the boiler room. This fact in itself was enough to tip the scales in favor of a cold process. Since the requirements of the plant called for very thorough removal of silica, the final recommendation was to use slu contact equipment to reduce silica content, then to finish with base exchange softening.

Sometimes, however, removal of silica may be exactly wrong thing to do. Hall records show many such instanc One typical case is that of a large plant in the Pittsbu area, using treated river water. This plant had no diffic in keeping boiler tubes clean during the winter, but fo them dirty at the time of summer inspections.

Adding silica cleared up the trouble. Hall Laborato prescribed this procedure because they knew that the hig acidity of the river water during the summer months ma

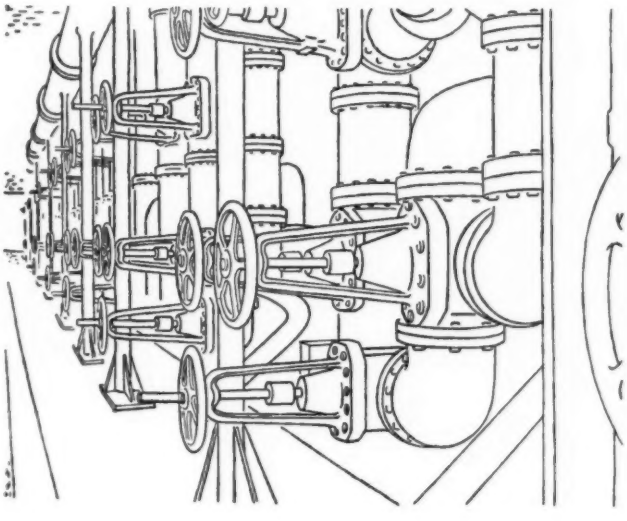
HAGAN
HALL
BUROMIN
CALGON

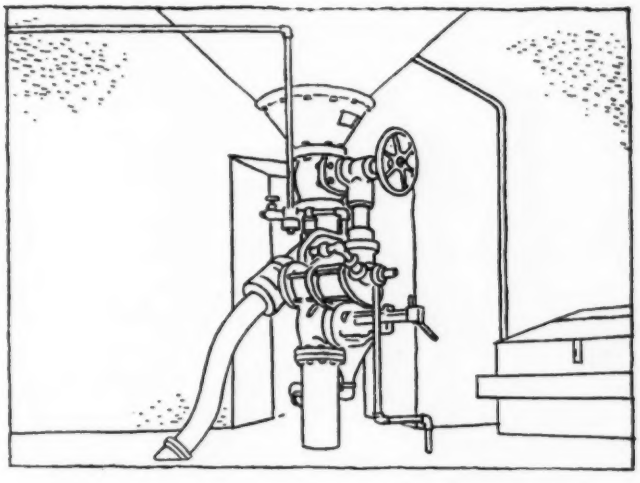
pre-treatment procedures?

deficient in silica, and that silica-deficient water produces a sticky, adherent sludge.

When water is deficient in silica, the accumulations on softener filter beds may seriously impair the efficiency of the filter. In many cases addition of the right amount of silica to the water produces a sludge which can be easily and fully removed by ordinary backwashing. In some cases, this treatment has increased filter efficiency to such an extent that investment in additional filter capacity was avoided.

These incidents illustrate a few of the factors that must be considered in prescribing pre-treatment pro-





cedures—and pre-treatment is only one of the many problems in the industrial use of water.

Hall Laboratories offers a complete service, covering not only boiler water conditioning but also the treatment of service and process waters, re-use or disposal of waste waters—and every other industrial water problem. They are prepared to recommend procedures which, taking all factors into account, represent the most efficient and economic course *in your specific situation.*

Correspondence on any industrial water problem is invited. Hall Laboratories, Inc., Hagan Building, Pittsburgh 30, Pa.

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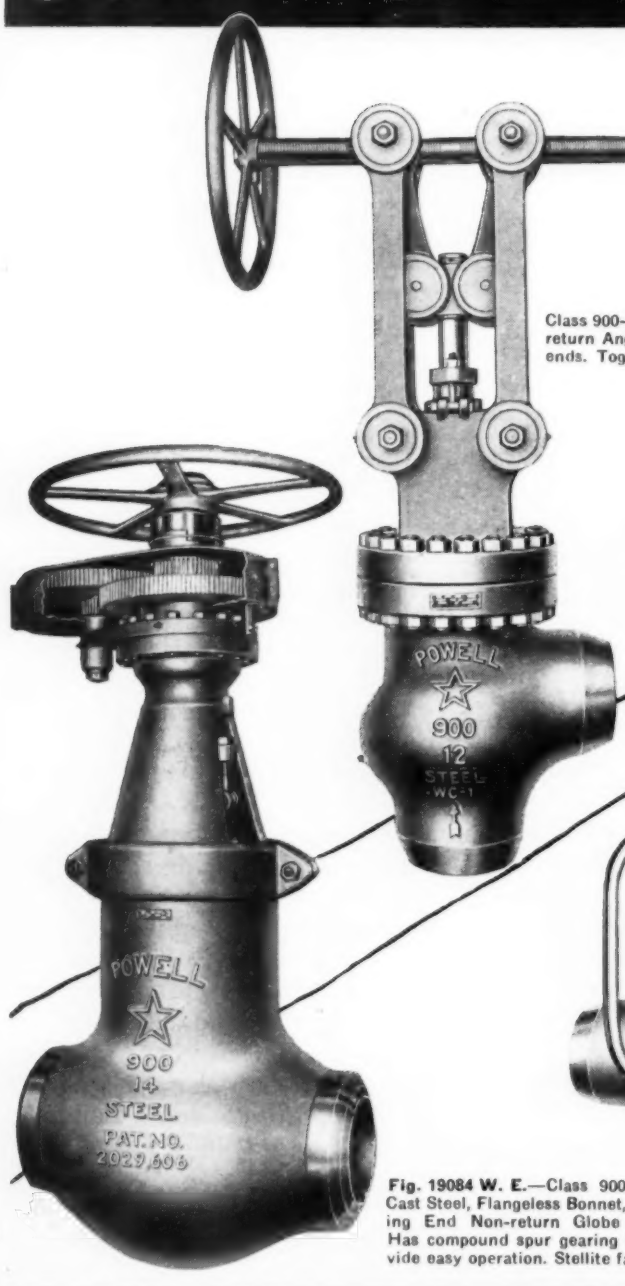
(A Subsidiary of Hagan Corporation)

CONSULTANTS ON
INDUSTRIAL WATER TREATMENT
HALL SYSTEM OF BOILER WATER CONDITIONING
INDUSTRIAL WASTE RECOVERY AND DISPOSAL

Smoothness in flow control... POWELL VALVES



Class 900-pound Cast Steel Non-return Angle Valve with welding ends. Toggle Operated.

Fig. 19084 W. E.—Class 900-pound Cast Steel, Flangeless Bonnet, Welding End Non-return Globe Valve. Has compound spur gearing to provide easy operation. Stellite faced.

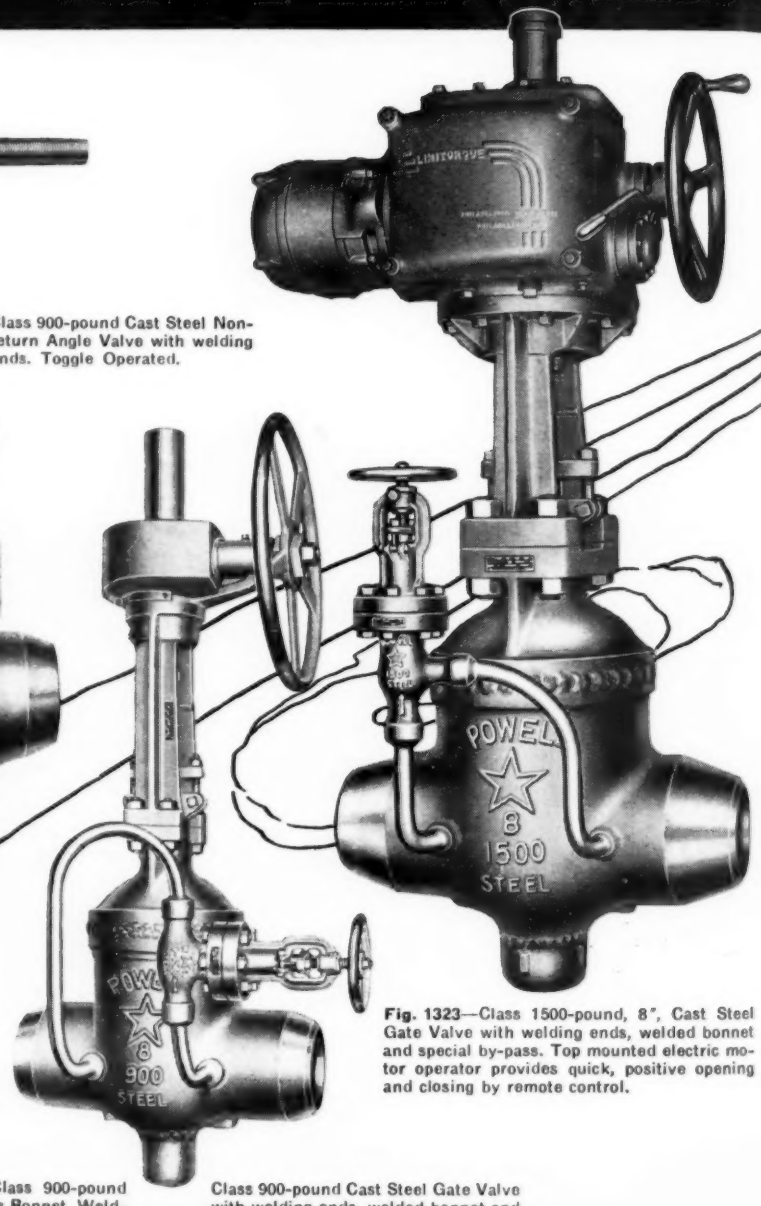


Fig. 1323—Class 1500-pound, 8", Cast Steel Gate Valve with welding ends, welded bonnet and special by-pass. Top mounted electric motor operator provides quick, positive opening and closing by remote control.

Class 900-pound Cast Steel Gate Valve with welding ends, welded bonnet and special by-pass. Bevel gear operated.

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Like the smooth performance of a birch bark canoe paddled by an expert on the still waters of a lake—that's the way a Powell Valve operates. For into every valve engineered by Powell go the skills accumulated through more than a century of making valves—and valves only.

Perfection of design, scientific selection of materials, finishing to exacting specifications—all contribute to the smooth, dependable performance that insures longer life and reduces maintenance to a minimum.

So when you need valves—either for new installations or for replacements—remember there's a "smooth" Powell Valve for every flow control service in modern industry.

The Wm. Powell Co., Cincinnati 22, Ohio

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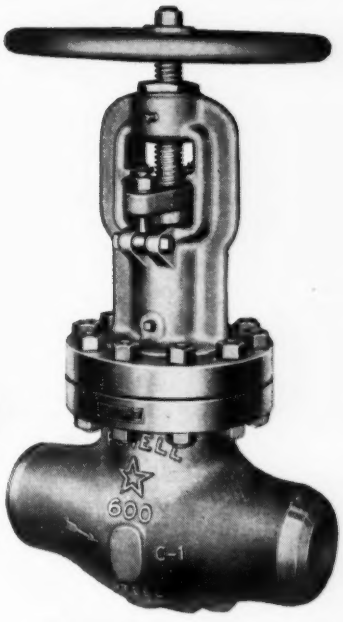

Fig. 6031 W. E.—Class 600-pound Cast Steel Globe Valve with welding ends, outside screw rising stem and bolted flanged yoke.

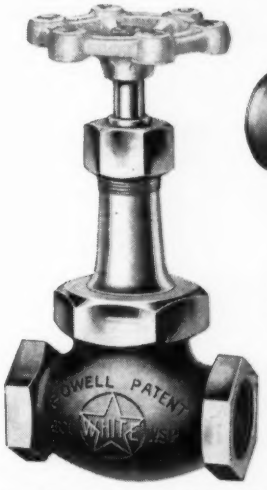

Fig. 1708—200-pound Bronze Globe Valve with screwed ends, union bonnet, renewable, specially heat treated stainless steel seat and regrindable, renewable, wear-resisting "Powellium" nickel-bronze disc.

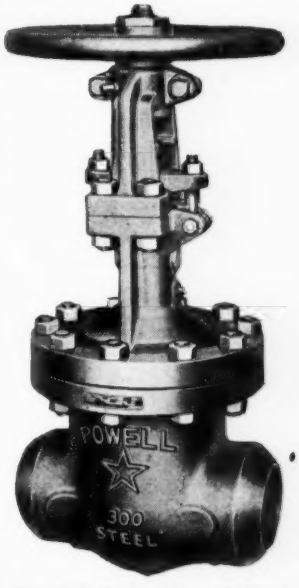

Fig. 3003 W. E.—Class 300-pound Cast Steel Gate Valve with welding ends, bolted flanged yoke, outside screw rising stem and taper wedge solid disc.

Fig. 241—Large 125-pound Iron Body Bronze Mounted Globe Valve. Made in sizes 2" to 16", incl. Has outside screw rising stem, bolted flanged yoke and regrindable, renewable, bronze seat and disc.

VALVES

high ratios?

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DE LAVAL DOUBLE REDUCTION WORM GEARS

De Laval double reduction speed reducers, consisting of combinations of double worm gear reductions, or helical and worm gear reductions, are available with overall ratios up to approximately 8000 to 1. De Laval single reduction worm gear speed reducers are available in ratios up to 90 to 1. If high ratios are your requirement, worm gear speed reducers are the answer—particularly if space is limited and reliability is important. A De Laval representative will help you pick the right size and type.

✳ This double reduction De Laval Worm Gear Speed Reducer is available in many standard ratio combinations, with horizontal or vertical output shafts and is but one of 93 sizes of standard De Laval Worm Gear Speed Reducers.

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TURBINES, ENGINES, AUXILIARIES; HYDRO POWER
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TRANSMISSION, LUBRICATION
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NEW *Life-Line* MOTORS NOW AVAILABLE

WESTINGHOUSE NOW OFFERS *IMMEDIATE DELIVERY* ON *STANDARD* LIFE-LINE MOTORS . . . IN RATINGS FOR 60% OF INDUSTRY'S REQUIREMENTS

To meet industry's urgent need for more—and better—motors, Westinghouse embarked two years ago on the biggest engineering and manufacturing program ever undertaken in this field.

Industrial buyers were surveyed to find the improvements most desired in existing standard motors. These improvements were incorporated, for the first time, in a single motor—the Life-Line—*a motor designed, from scratch, to user specifications.*

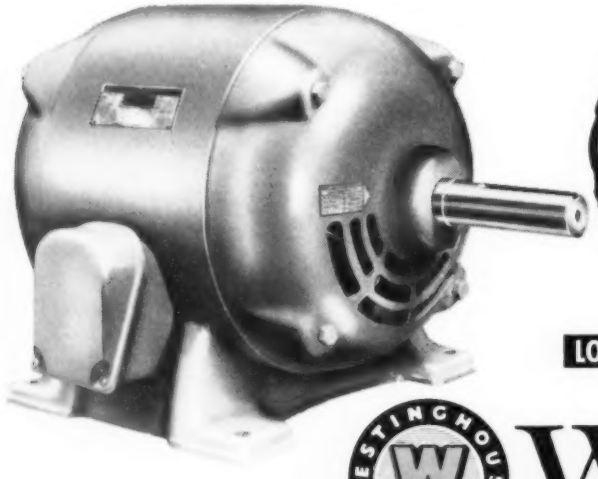
To build the Life-Line motor, a complete new plant was purchased, tooled and equipped from the ground up, with machines and new techniques never used before to manufacture motors.

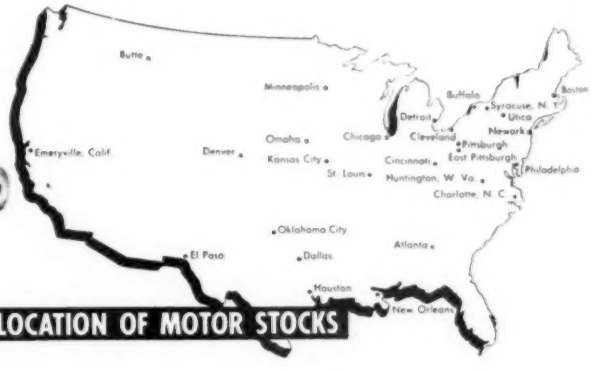
Today, we announce the attainment of our first objective. The new Life-Line motor is now available from stock, in standard types from 1 to 15 hp.

This objective was selected as of first importance, since 60% of standard, integral horsepower motors required by industrial users fall in this classification. Motor types included in stock are described on the opposite page. On "near-standard" motors, also described, short deliveries are available in these sizes.

Improved deliveries on special types and larger ratings will be the subject of future announcements, as quickly as increased output makes them possible. Watch for them . . . phone your orders from this stock list to your nearest Westinghouse representative. Westinghouse Electric Corp., Box 868, Pittsburgh, Pa.

J-21447





WESTINGHOUSE

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

FROM 1 to 15 HP FROM STOCK

WHAT IS MEANT BY "STANDARD" MOTORS

"Standard" motors include drip-proof, splash-proof, totally-enclosed, fan-cooled and some totally-enclosed, non-ventilated complete motors, ball-bearing type, having standard electrical characteristics (220/440 volt, 2 or 3-phase, 50 or 60-cycle, standard speed torque and time-temperature characteristics).

Available from stock in ratings indicated below. Very short delivery on any standard non-stock rating in these frame sizes.

TYPES INCLUDED AS "NEAR-STANDARD" MOTORS

"Near-standard" motors are those with minor modifications, which include such items as double shaft extensions, NEMA standard B and C flanges, special No. 1 insulation, round frame, conduit box opposite standard, squeeze connectors instead of conduit box, TENV motors, partial motors, 50-cycle, 40° C. rise open motors, etc.

Short delivery in frame sizes listed below.

Life-Line A-C, Single-Phase, 60-Cycle, 110-220-Volt, Heavy-Duty Type CAP Capacitor-Start, Induction-Run Motors

HP	RPM	FRAME	VOLTS	IN STOCK
1	1750	203	220	√
1½	1750	204	220	√
2	1750	224	220	√
3	1750	225	220	√

Life-Line A-C, 3-Phase, 60-Cycle, Squirrel-Cage Motors

HP	RPM	Frame	Volts	ENCLOSURE TYPES IN STOCK		
				Drip-Proof	Splash-Proof	Totally Enclosed
½	860	204	220/440	√		√
¾	1150	203	220/440	√		√
	1150	203	550	√		√
	850	224	220/440	√		√
1	1750	203	220/440	√		√
	1150	204	220/440	√		√
	850	225	220/440	√		
	850	225	550	√		
1½	3450	203	220/440	√	√	
	1750	204	220/440	√		√
	1150	224	220/440	√		√
	860	254	220/440	√		
2	3450	204	220/440	√		
	3450	204	550	√		
	1750	224	220/440	√	√	√
	1750	225	220/440			√
	1150	225	220/440	√	√	√
	860	254	220/440	√		√
	860	254	550	√		
	710	284	550	√		

HP	RPM	Frame	Volts	ENCLOSURE TYPES IN STOCK		
				Drip-Proof	Splash-Proof	Totally Enclosed
3	3450	224	220/440	√		
	3450	224	550	√		
	1750	225	220/440	√	√	√
	1750	225	550			√
	1135	254	220/440	√	√	√
	875	284	220/440	√		
5	3450	225	220/440	√	√	
	1735	254	220/440	√	√	√
	1735	254	550	√		
	1200	284	220/440	√	√	√
	875	324	220/440	√		
7½	3470	254	220/440	√		
	1740	284	220/440	√	√	√
	1740	284	550	√		√
	1160	324	220/440	√		
	865	326	220/440	√		
10	3500	284	220/440	√	√	
	1740	324	220/440	√		√
	1740	324	550			√
	1155	326	220/440	√	√	
	870	364	220/440	√		
15	3500	324	220/440	√		
	1750	326	220/440	√	√	
	1160	364	220/440	√		
	1160	364	550	√		
	875	404	220/440		√	

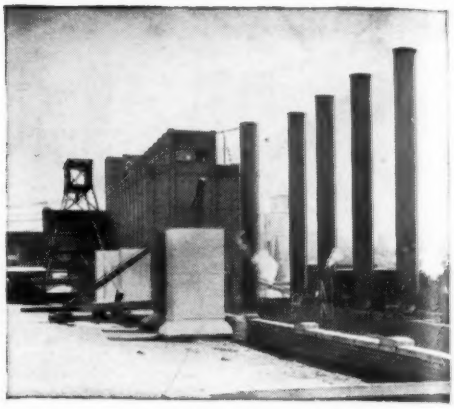
Subject to prior sale.

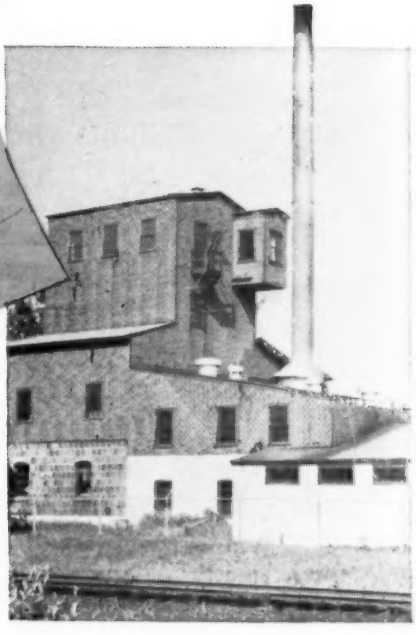
Life-Line motors

MORE PRODUCTIVE POWER FOR INDUSTRY

Is your smoke stack problem like any of these?

Solve it with BYERS WROUGHT IRON





A large manufacturing plant in Pennsylvania needed a 130-foot stack . . . a paper mill in Maine required four new stacks to take care of expanded facilities . . . a chemical company in New York wanted a 54-foot stack. In all three instances the designers and engineers recognized the hazards that an unlined metal stack must face, and chose the same time-proven means of getting maximum life from the installations. All the new stacks were fabricated of Byers Wrought Iron.

SERVICE RECORDS SUPPORT CHOICE

The performance of wrought iron stacks installed in all sections of the country provides convincing evidence of the soundness of the choice. Several of the most dramatic demonstrations of the durability of wrought iron have been in stacks which were constructed of a combination of wrought iron and low-first-cost material. In one such instance, the top 20-foot section of a wrought iron stack was replaced, after 22 years service, by ordinary materials. The new section failed in only 4 years . . . one-fifth the life of wrought iron. Wrought iron was then used to replace a 50-foot top section—20 feet of which was ordinary material, and the balance 26-year-old wrought iron. At last report, the new top section and the original bottom section, then 34 years old, were still on the job.

DEFENSE SECRET

The secret of wrought iron's resistance to corrosion is found in its unique composition and structure. Tiny fibers of glass-like silicate slag, threaded through the body of high-purity iron, halt and "detour" corrosive attack, and so discourage pitting and penetration. The fibers also help anchor the initial protective scale, which shields the underlying metal.

BULLETIN FREE ON REQUEST

Our bulletin, "Wrought Iron for Flue Gas Conductors and Coal Handling Equipment", discusses the stack problem in detail, analyzes the corrosive conditions involved, and illustrates a number of applications where wrought iron has been successfully used. Ask for a complimentary copy.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, Seattle, San Francisco. Export Division: New York, N.Y.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

BYERS

GENUINE WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

POWER

PHILIP W SWAIN, EDITOR • FEBRUARY 1948 • ESTABLISHED IN 1882

IT TAKES ONLY TWO

WHEN PLANTS WERE SMALL and life was simple, "employe relations" didn't stand for a national problem; it merely described the way the boss got on with his men. But industry grew, the chain of command lengthened and there was an inevitable need for standardizing the relations between the many bosses and the many employes.

The art of personnel management came into being and, to a great extent, parts of the old-fashioned relationship between boss and men became the work of specialists—recruiting, hiring, setting up wage and salary schedules, determining general personnel policy.

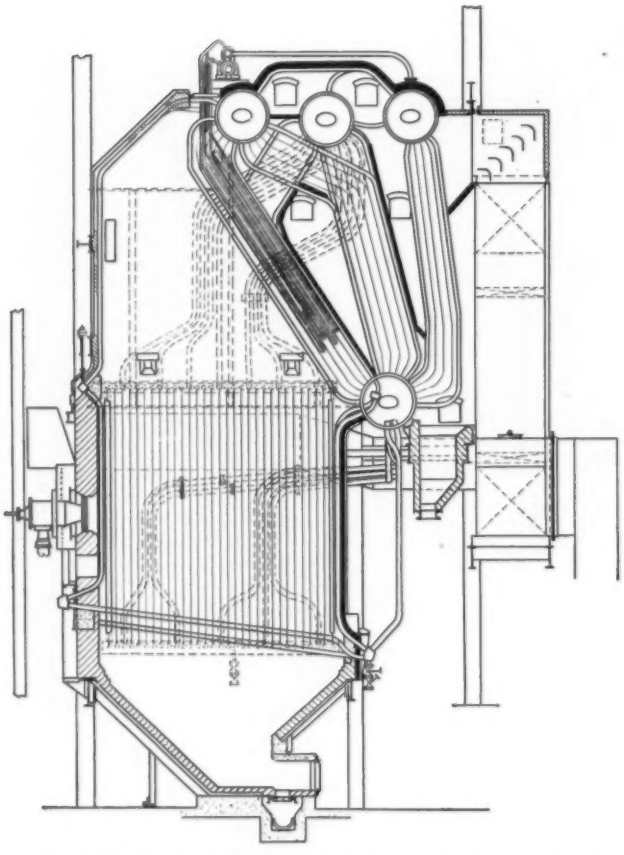
Much good resulted. The business of finding the right people for jobs and the right jobs for people goes more smoothly now than it once did. Most large companies offer group insurance, medical service, recreation programs, pensions and other "employe benefits." The requirements of today's jobs are carefully evaluated and the merits of employes measured against them with equal care.

But with it all has come a tendency for most of us to sit back and let the "experts" take care of personnel matters. What's more, we've come to think of the people who work with us as a group, not as the individuals they are. Nothing could be more unfortunate.

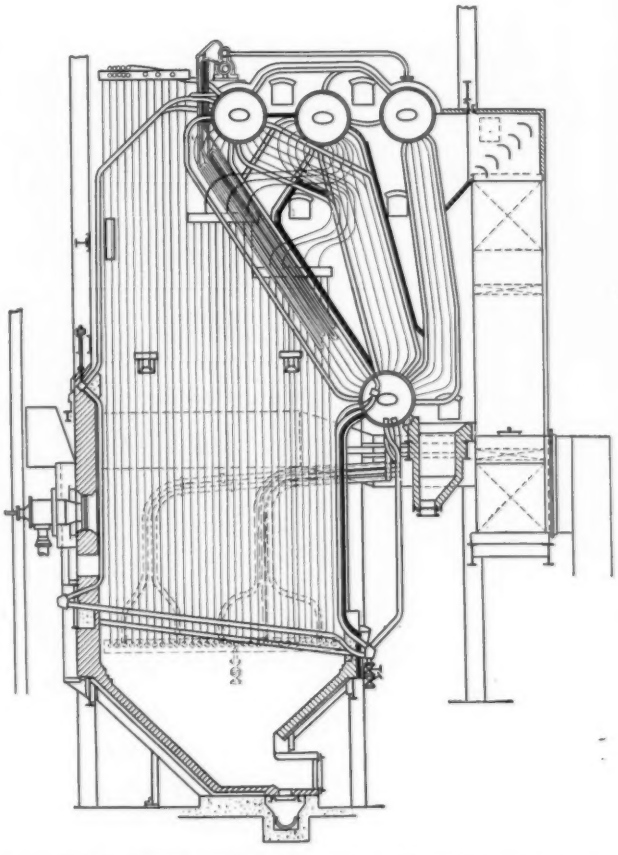
A General Electric executive summed it up in a phrase recently—". . . it takes only two to make a job—the boss and the individual employe." To the employe nothing is more important than his personal affairs. He can't help seeing the situation in direct terms. On one side there is the man he works for—on the other side he stands, working to better himself and his family, to satisfy, in countless ways, his *personal* drives and ambitions. To refuse to see the job relationship the way the employe does is to miss the biggest chance any boss has for success in his own assignment.

To no one is this more important than to the power engineer. Even in a large plant he works with a relatively small group of employes. They have a variety of assignments that appear routine on the surface but call for initiative and often for the quick exercise of sound judgment. In such a setup, the individual approach pays maximum dividends; the lack of it is fatal.

What to do about it? Start by cultivating the habit of thinking of Joe Doakes as father of two boys, high-score bowler, raiser of prize roses, not merely as fireman, second class. You'll discover what anyone knows who knows Doakes personally—he is ambitious, a sound thinker but feels he's handicapped by lack of a technical education. You'll help him get the training he needs, put him to work where good judgment and technical understanding are required, let his ambition build his future. And as you build his job, and those of the other men in the plant, you'll build yourself as a boss. It takes only two to make a job.



1 High-priced premium coal was the only fuel that produced the rated steaming capacity from existing generators, above



2 Extending waterwall surface reduced heat release to about 24,000 Btu per cu ft, permitting the use of available coals

When You Modernize Do a Complete Job

Why restrict to new steam generators the dollar savings possible from a wide selection of fuels? Here's an industrial that equipped its whole plant to use one fuel and reaped savings

▶ BENEFITS IN OPERATION, maintenance and fuel savings, which accrue to a sound and amply designed steam generator, should not be lessened by the presence of older units in a boiler room. U. S. Industrial Chemicals, Inc, took steps to make sure this didn't happen in their Curtis Bay, Md. power plant.

This plant had a battery of two 115,000-lb-per-hr 650-psi 700-F 4-drum bent-tube pulverized-coal-fired steam generators and several 30,000-lb-per-hr 150-psi saturated straight-tube single-retort stoker- and oil-fired boilers. Steam demand had grown to where additional capacity was necessary.

In planning this addition considerable thought was given to the advantage of fuel flexibility. When the new unit was installed the low-pressure boilers were taken off the line and discarded, but the output of the higher-pressure units was still needed. And to get anywhere near rated output entailed heavy concessions.

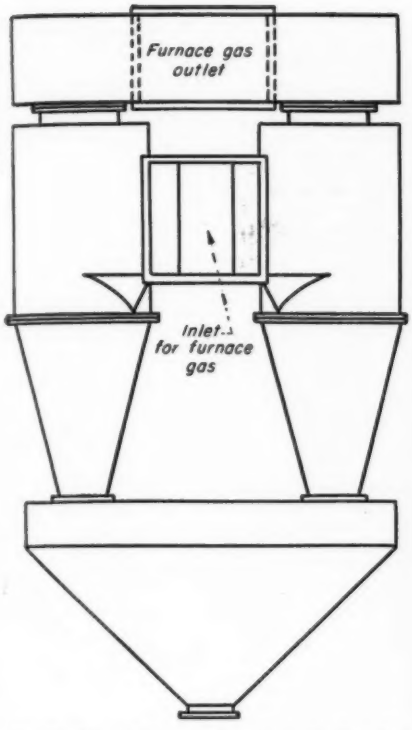
Furnace Operation. For instance, the original steaming capacities were based on a coal that has been a premium one for years. Pulverizers, burners and furnace required this fuel. It left only three courses of action (1) use of the premium coal with its high cost (2) use of less expensive, available coal together with oil to bring up the available Btu—likewise costly (3) considerably reduced output that varied with the coal on the market.

The last two courses were followed and they produced operating and maintenance difficulties that increased boiler-room costs. Here's what happened.

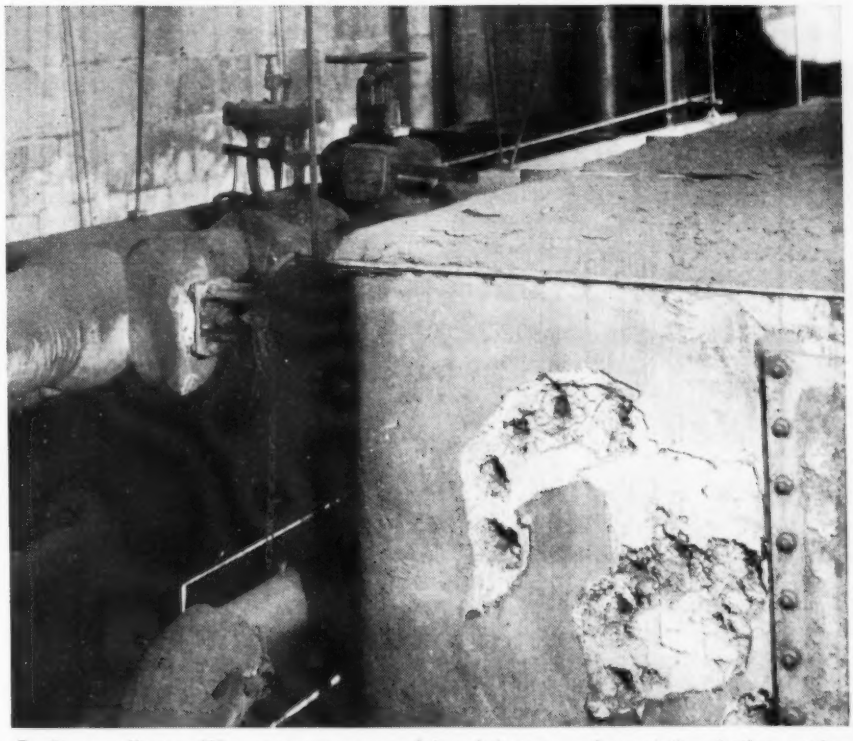
The grade of coals available on the market had low fusion temperature, low grindability, fairly high ash-and-moisture content.

To get a desired degree of fineness of pulverization (about 80% through 200 mesh) the impact-type pulverizer suffered severe wear, and replacements became a heavy item. Firing coal of lesser fineness aggravated an already serious ash problem.

Ash Formation. This ash problem, directly traceable to the coal, presented itself in this way: The furnace waterwall and heat-absorbing surface was insufficient to hold down furnace temperature to anywhere near the fusion temperature of the ash. In addition, flame



3 Cyclone dust collector has single inlet and outlet with "shave-off" for fines



4 Dust collector (3) mounts in space (above) between the existing boiler setting and wall. Separation plate directs outlet gas to collector before the air heater

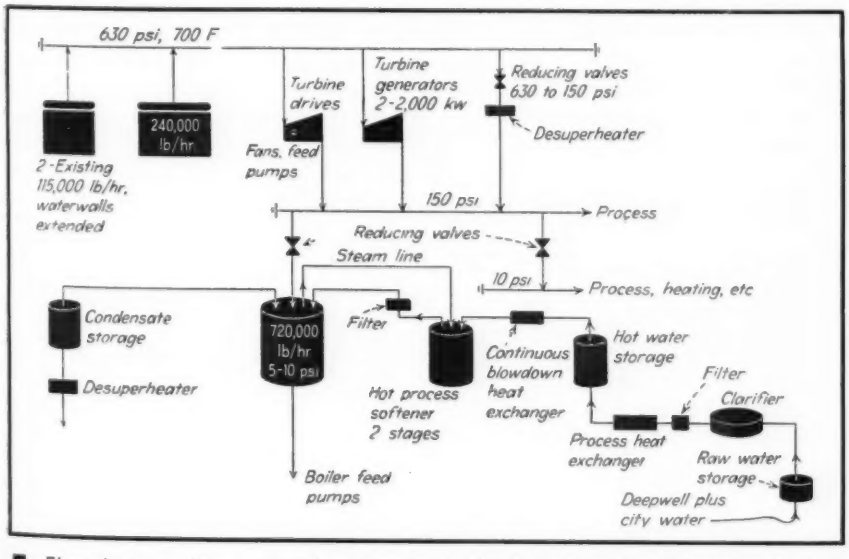
length was dangerously near the point of impingement. The result was a heavy slagging action in the refractory-lined furnace-wall area immediately above the top waterwall headers.

This slag accumulation grew. Its only remedy was a heavy hand-lancing program. Even at that, under prolonged periods of heavy steaming, the accumulation would get ahead of the slag-removal program. On occasion, built-up pieces of slag, weighing upward of 500 lb would fall off the wall and come crashing down on the ash-screen tubes across the furnace floor. A ruptured ash-screen tube represented an imminent operating hazard.

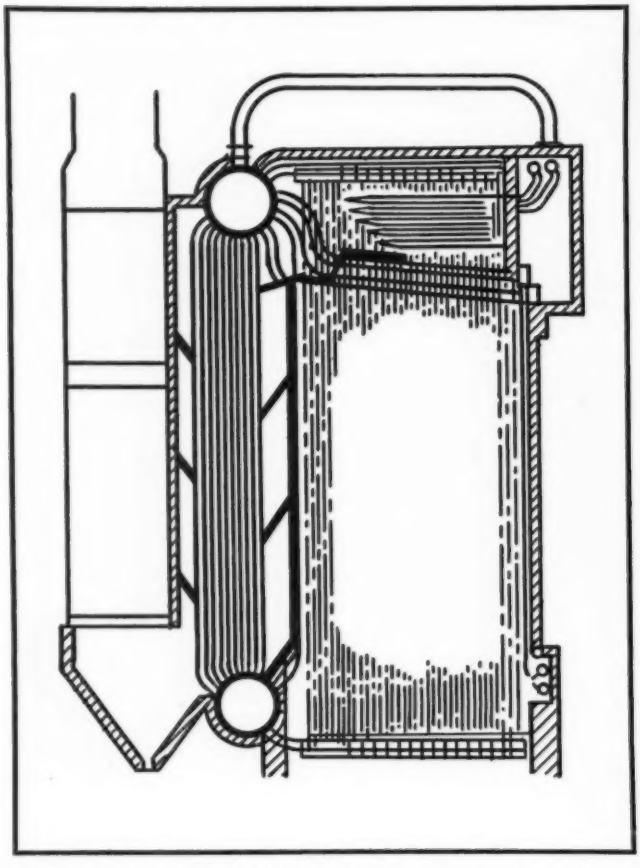
Still another difficulty—draft—developed from slag formation. As the slag grew the induced-draft fan had in effect an added baffle placed in the path of the furnace gas. The fan could be speeded up to overcome this added pressure drop, but only within limits.

New Setup. When the new high-pressure steam generator came on the line it was decided to make a capital expenditure in the old boilers to fit them to fire the same fuel. Without it, separate coal-handling and storage provisions would have to be made anyway. These measures were adopted: (1) waterwall surface extended (2) pulverizers and burners replaced (3) mechanical dust collectors added at the boiler exit before the air heater.

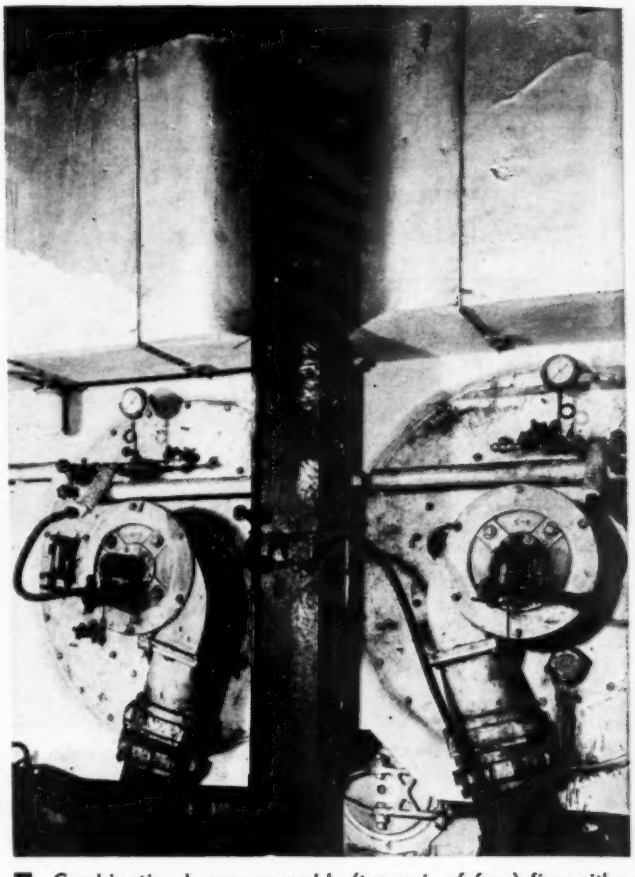
The additional waterwall surface gives a heat release in the old units of about 24,000 Btu per cu ft per hr—a more practical value and a major step in itself towards reducing slagging troubles. The new bowl-mill pulverizers, built to handle coals of a Hardgrove grindability of 55, produce fineness of about 80% through 200 mesh with available market coals. The practical steam-generating capacity is increased to near original rating by (1) increased heating surface (2) additional head for boiler-water circulation (3) improved coal fineness. Before the change the old unit needed an expensive combination of coal and oil to reach this output, and developed not more than 90 000 lb per hr on coal alone. Changing the



5 Flow diagram shows general arrangement of major elements in plant modernization. Each steam generator carries in addition its own pulverizers, dust collectors



6 First of two 240,000-lb-per-hr steam generators of conservative design. Heat release is only 14,700 Btu per cu ft



7 Combination burner assembly (top pair of four) fires either coal, oil or a combination for complete fuel flexibility

burner gave a different flame shape—one much shorter. This permits more complete combustion within the present furnace without danger from impingement.

Extended Waterwall. Fan capacity for the new conditions was adequate. The only modification was a change in the gear reducer to meet the increased load and a different admission nozzle for increased speed in the steam turbines driving the fans.

Some changes had to be made in the waterwall supports for the new tube lengths. No change in tube diameter was made. The extensions were welded to the old tubes and rolled into the new headers. A 45-deg separation plate at the gas outlet from the boiler convection surface directs the outgoing gas into the mechanical dust collector. From there it enters the air heater, and through induced-draft fan and breeching goes to a 200-ft chimney.

All these steps are only part of a full-scale boilerhouse modernization. That modernization, made necessary by a rapidly growing demand for steam, has been founded on a conservative, soundly engineered new steam generator. This unit and another to follow are rated at 240,000 lb per hr at 630 psi, 700 F.

A common header receives the output of both the new and older boilers. It furnishes steam for two 2000-kw back-pressure turbine-generators, fan and feed pump drives and two reducing valves. Additional turbine-generators are planned. Exhaust from these turbines and output from the reducing valves enter a 150-psi process header. Two reducing valves at this level bring steam to (1) 10-psi process line (2) deaerator and hot-process softeners.

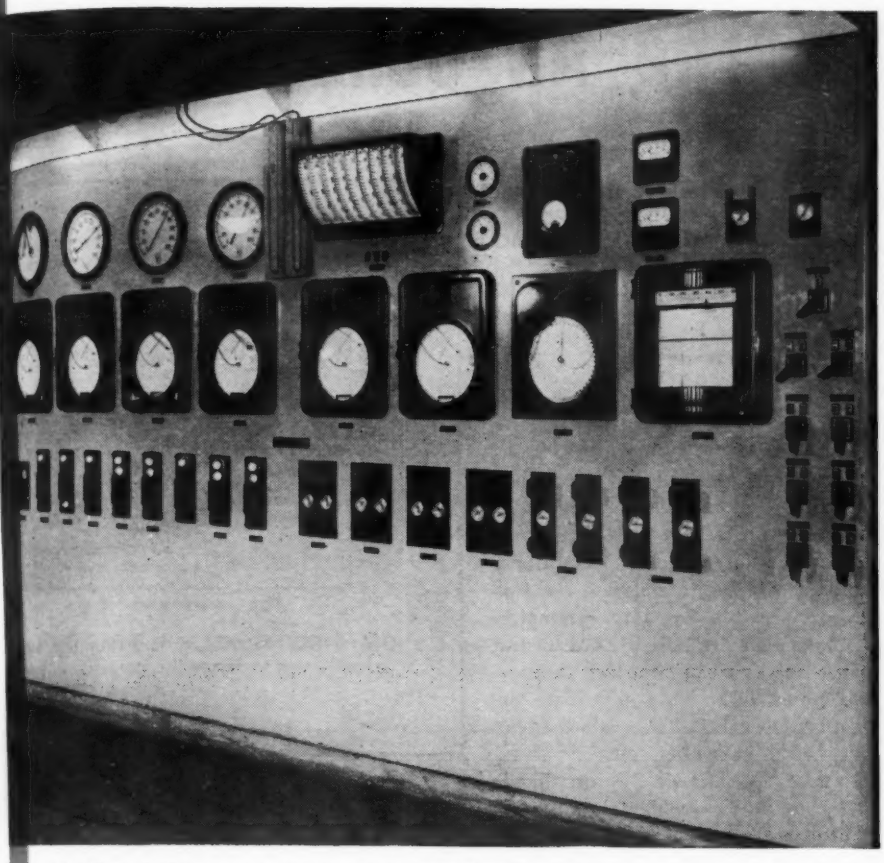
Fuel Selection. Before any selection of design for the new boiler was made the U. S. Industrial Chemicals, Inc considered all coal fields in north-

I—Coal-Analysis Range, Purchasable

	Minimum	*Maximum*	*Predominating*
Moisture	1	11	3-5
Volatile	14	38	{28-36 {15-22
Fixed carbon	52	76	60-70
Ash	6	24	7-12
Sulphur	1	4	2-3
Btu	9800	14,000	12,500-13,500
Fusion temperature	1838	2900	2100-2400

II—Fuel Analysis as Design Basis

Ultimate analysis	*Proximate analysis*
H_2— 4.5	Btu/lb—12,737
N — 1.4	Moisture—4.8
C —72.2	Volatile—29.35
S — 1.7	Carbon—54.79
O — 4.3	Ash—10.98
Moisture—4.9	Softening temp ash—1950 F
Ash—11.0	Hardgrove grindability—55



8 Main boiler-room instrument board affords fireman complete control of steam generator plus set of charts for permanent records on vital equipment performance

eastern West Virginia, southern Pennsylvania and all of Maryland. From this survey they drew up a coal-analysis range desirable to purchase, Table I, and selected an average eastern bituminous coal with characteristics in Table II. This fuel served as a basis around which to design a new steam generator.

Each element of that generator received the same thorough, sound reasoning. For instance, the furnace has been designed to burn a coal with an ash-softening temperature of 1950 F, at a heat release of 14,700 Btu cu ft per hr. The pulverizers, fans and other auxiliaries are built with a margin for overload. In fact, this unit has already produced up to 300,000 lb per hr with no noticeable difficulty. Provisions have been made for oil-burning as well as for coal.

A mechanical dust collector has been located after the gas outlet from the boiler convection section and before the air heater, a spot similar to that in the older, revamped boilers. The gas finally enters a new stack mounted on the boiler-room extension.

Water Supply. In a similar fashion the water system includes provisions that will enable it to handle up to 720,000 lb per hr—the ultimate planned plant load.

This water supply enters the system from two sources, condensate returns (up to 30%) and raw water (70 to 90%). Raw water comes from deepwell pumps or city supply mains. This tie is necessary because there is a definite limit on the waters that can be drawn from the wells. A raw-water storage tank with a float-operated valve receives city water when the float falls below a definite level.

From here the water passes through a clarifier in which the alumina clay in suspension is removed. Discharge from the clarifier undergoes a cold-water filtering operation before admission to some process-heat exchangers. After gaining in temperature from this service the water goes through the first and second stages of a hot-process softener and a set of hot-water filters. It is now ready for the deaerating heater and then the boiler feed pumps.

Condensate returns to its own storage tank, and leaves from there for the deaerating heater where it joins the makeup water supply. A live-steam line from the 150-psi header supplies through a reducing valve enough steam to hold the deaerator pressure at 5 to 10 psi. A line from the deaerator goes to the first stage hot-process softener, where most heating is done and air is vented.

Feedwater Treatment. These hot-process softeners serve chemical feedwater treatment. Feeder lines, direct to the boiler drums for phosphate and t the deaerator for sulphite, are installed in the event such chemical treatment is temporarily required.

PRINCIPAL POWER-PLANT EQUIPMENT

Curtis Bay, Md. Plant of U. S. Industrial Chemicals, Inc

STEAM-GENERATING EQUIPMENT:

Boiler, 240,000 lb per hr, 630 psi, 700 F....Combustion Engrg Co, Inc
Waterwall surface,
extensions to existing unit.....Combustion Engrg Co, Inc
Pulverizers, 4, bowl-mill type,
80% through 200 mesh.....Raymond Pulverizer Div
Burners, 4 RO type, combination, coal, oil..Combustion Engrg Co, Inc
Burners, 4, differential-pressure type.....Peabody Engrg Corp
Fans, 2, induced and forced, turbine driven.....B F Sturtevant Div
Turbines, 2, 630-psi steam exhausts at 150..Terry Steam Turbine Co
Combustion control, 2, compressed-air operated.....Hagan Corp
Dust collector, 1, present boilers 160,000 lb of gas per hr,
243 tubes .....Prat-Daniel Corp
Dust collector, 1, new boiler, mechanical, tubular—Buell Engrg Co, Inc
Flowmeters .....Bailey Meter Co
Pyrometer, recording, 12 point.....Leeds & Northrup Co
Recorders, CO_2.....The Hays Corp
Regulators, feedwater, 2-element and 3-element....Bailey Meter Co
Water-level indicator.....Reliance Gauge Column Co
Water columns, bi-color.....Diamond Power Specialty Corp
Soot blowers, sequential system on new; de-slagging, etc,
on old .....Diamond Power Specialty Corp

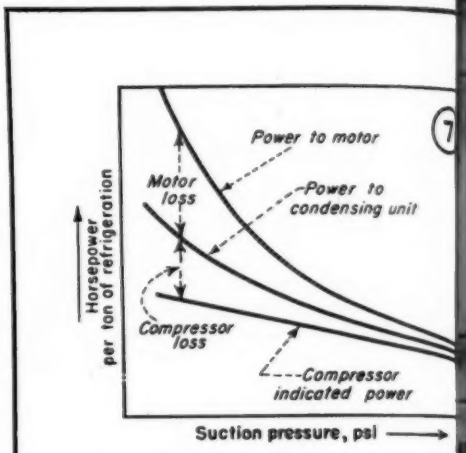
PUMPS AND WATER CYCLE:

Feedwater, 1, 700 gpm, turbine-driven, differential-
pressure control .....Ingersoll-Rand Co
Turbine, 1, 630-psi supply steam exhausts
to 150 psi.....Terry Steam Turbine Co
Deaerating heater, 1, 720,000 lb per hr, 5 to 10 psi....The Permutit Co
Water softener, 1, hot process, 2 stage,
504,000 lb per hr.....Cochrane Corp
Clarifier, 1, cold water, 1 stage, 63,000 gal per hr.....Infilco Inc

Fit The Air-Conditioning

This concluding article shows how to solve design problems. Part I gave reasons for studying building requirements and making a complete physical survey before designing a system

By J D CONSTANCE, *Professional Engineer*



ON A GIVEN LOAD, lowering the suc pressure will increase the horsepower pe

▶ THE SIMPLE EXPEDIENT of installing less cooling surface and operating it at lower temperature sometimes materially reduces the first cost of equipment. Because the combined condensing unit and evaporator fit the load at a lower suction pressure, the horsepower requirements per ton of refrigeration increase, Fig. 7. But this increased power use is offset by the attendant improvement in comfort conditions at the lower indoor humidities.

Change in Humidity. Conversely, a slight increase in design-indoor humidity may use greater coil surfaces and, therefore, a more expensive evaporator assembly, but lower power-consuming refrigeration equipment. Of course, less comfortable conditions of humidity prevail. Since condensing-unit capacity varies in steps according to motor size, a change in design-indoor humidity may easily determine economies in first cost of the condensing unit. Variations in design-indoor dry-bulb temperature affect equipment selection similarly but to a different degree.

Economic selection of equipment thus requires a balance between operating expense and fixed charges. Although total cost may be reduced by slight changes in design-indoor conditions, these are beyond the control of the application engineer in industrial and process applications, and often in comfort installations, because conditions are either defined by the process or set by contract. He must confine his efforts, therefore, to variations in air flow and characteristics of heat-transfer surface in arriving at the most economical arrangements.

Conditions That Need Reheat. The straight line joining points 1 and 2 in Fig. 8 may fail to intersect the saturation line (Part I, Jan 1948, p 80) because of high latent-heat load requirements. This indicates that the ratio of latent- to sensible-heat loads (curve slope) is so great as to require an additional air-treating device. Remember that surface-type equipment has definite limitations with respect to dehumidification. Once entering-air conditions, point 1, are set, the maximum ratio of latent to sensible capacity attainable with that particular coil is fixed by the steepest line that can be drawn through initial point 1, and yet terminate on the saturation curve. This is a tangent to the 100% saturation curve. Thus, with the entering-air point fixed, changes in surface-cooler design and modifications to air flow, such as bypassing, Fig. 9, will not further increase the amount of dehumidification with respect to sensible cooling. This holds true for extended surface coolers of all types.

Reheat or Sorbent. Only alternative is to supplement the surface cooler by some device that alters the temperature or humidity of the air. One method is to reheat the air, Fig. 10, after it has been cooled and dehumidified. Another way is to dehumidify the air chemically, Fig. 11, before passing it to the surface cooler. Reheat is commonly used when the ratio of latent to sensible heat is greater than can be handled simultaneously in a single process. Air entering the conditioner may be cooled by a surface maintained at some temperature below the initial dewpoint corresponding to 2 on Fig. 8, to some point where the correct amount of moisture has been removed. In removing the latent heat and sweating out moisture from the air stream, more than the required amount of sensible heat is removed. This results in a low dry-bulb temperature.

Watch Dry-Bulb Temperature. If air is introduced to the conditioned space without further treatment, dry-bulb temperature will be below the design value. With normal ceiling height, architectural treatment and supply-grille setting, dry-bulb temperature of entering air should not be more than 15 F below design value. To avoid too low a temperature or too great a diffusion, the air stream leaving the cooling coil must be warmed by a reheat coil in the conditioner or in the supply duct.

If point 3, Fig. 8, is the fixed condition of air supply to the conditioned space, length of line 2 to 3 represents reheat requirements. Ideal setup is to condition the air down to the introduction point, but this is seldom done in practice.

Problems on Selection. The following example illustrates the principles involved in selecting equipment for cooling and dehumidifying. For comfort cooling, the design conditions could apply to areas in and around New York City and Tampa, Florida.

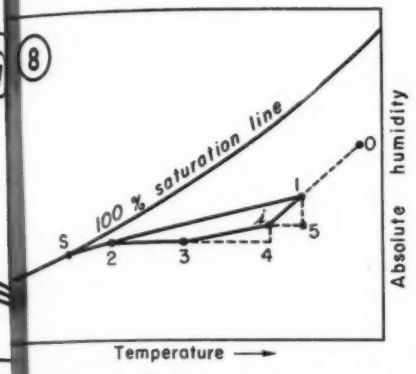
DESIGN CONDITIONS

Outdoors, 95 F dry bulb, and 78 F wet bulb
Indoors, 80 F dry bulb, and 50% relative humidity
Outdoor air supply, 1340 cfm
Total sensible heat gain, 87,000 Btu per hr
Total latent-heat gain, 48,300 Btu per hr
Ratio, latent-to-sensible-heat gains 0.56
Total air circulation, 4000 cfm

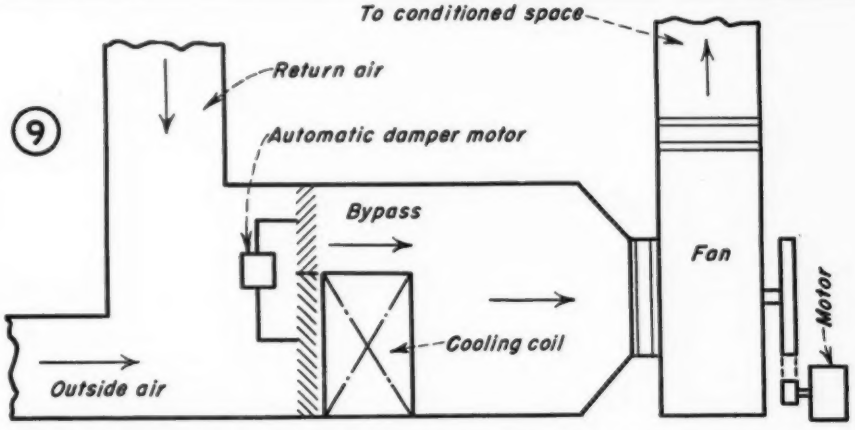
The absolute humidities at design outdoor (o) and indoor (i) conditions are determined from the psychrometric chart (see Jan 1948 POWER, p 83, for explanation of symbols):

w_o = 117 grains per lb
w_i = 77 grains per lb

System To The Load



GH LATENT-HEAT LOAD is indicated if line 1-2 fails to touch saturation curve



CHANGES IN DESIGN of the surface cooler and bypassing do not increase the dehumidification with respect to the sensible cooling if the air conditions are fixed

The conditions of air entering the cooling surface are determined from:

$$9. \quad t_1 - t_i = \frac{M_0}{M}(t_0 - t_i)$$

$$10. \quad w_1 - w_i = \frac{M_0}{M}(w_0 - w_i)$$

and thus,

$$t_1 = 80 + \frac{1340}{4000}(95 - 80) = 85 \text{ F}$$

$$w_1 = 77 + \frac{1340}{4000}(177 - 77) = 90.4 \text{ gr per lb}$$

Air-Flow Rates. On the psychrometric chart this corresponds to a wet-bulb temperature of 70.8 F. Note that we used volume-flow rates instead of weight-flow rates called for in the equations. Resulting error is so slight that this method may be used without affecting the final result within measurable limits.

Rating tables for cooling surface may be used if available. They give latent and sensible heat capacities for various dry- and wet-bulb temperatures, refrigerant temperatures and airflow rates. Together with condensing-unit ratings of suction temperature or pressure, speed, condensing-water requirements and capacity, a graph similar to Fig. 6 in Part I may be developed.

For this type of application use an evaporator temperature of 45 F. All that is necessary is to plot two points and draw a straight line through them, treating both condensing unit and coil in the same manner. It is merely necessary to select a surface having a 56% ratio between latent- and sensible-heat capacities when extracting 87,000 + 48,300 = 135,300 Btu per hr.

This is equivalent to removing heat equal to 135,300/12,000 = 11.28 tons refrigeration from about 4000 cfm of air initially at 85 F dry-bulb and 70.8 F wet-bulb temperature.

Required temperature and humidity of the air leaving the cooling surface, point 2 in Fig. 8, may be determined from:

$$11. \quad t_1 - t_2 = \frac{H_s}{1.06 \times Q} \text{ and}$$

$$12. \quad w_1 - w_2 = \frac{H_l}{0.66 \times Q}$$

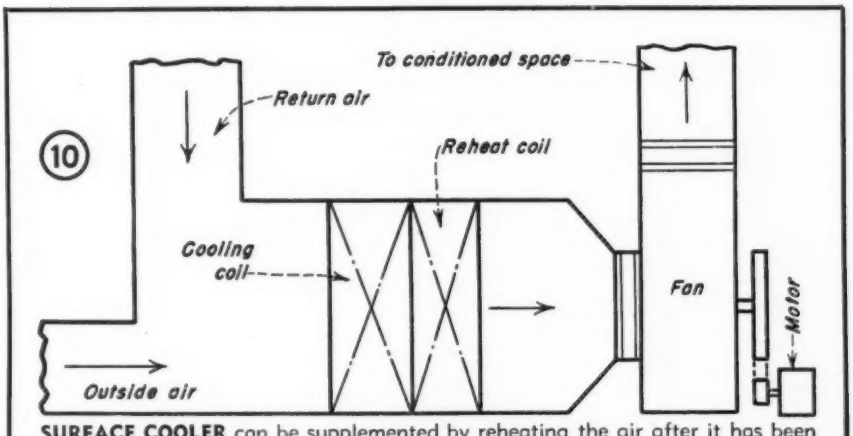
Accordingly, our figures show that:

$$t_2 = 85 - \frac{87{,}000}{1.06 \times 4000} = 64.5 \text{ F.}$$

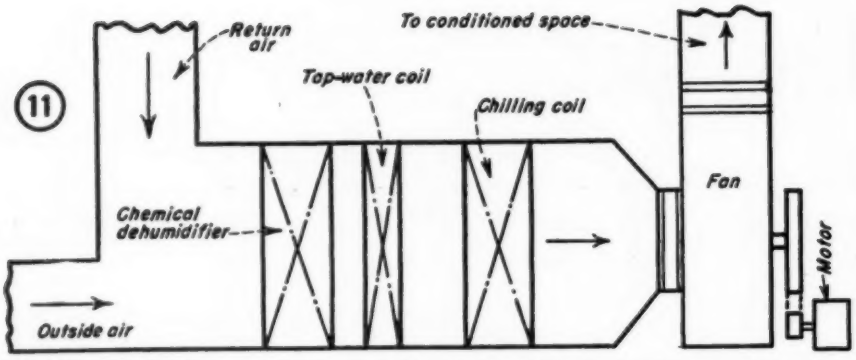
$$w_2 = 90.4 - \frac{48{,}300}{0.66 \times 4000} = 72.1 \text{ gr per lb.}$$

Surface Temperature. Locating points 1 and 2 on a psychrometric chart, skeleton form Fig. 8, and extending the straight line joining them until it intersects the saturation curve, we find the required surface temperature, t_s, is 54 F. Another common term for this value is "apparatus dewpoint."

Mean temperature difference between



SURFACE COOLER can be supplemented by reheating the air after it has been cooled and dehumidified when the ratio of latent to sensible heat is high



WHEN THE RATIO of latent to sensible heat is high the surface cooler can be supplemented by dehumidifying the air chemically before it enters the cooling coil

Heat-Transfer Coefficient Vs Face Velocity

Face Velocity, fpm	h_a *Btu/hr/sq ft/F*
350	5.9
400	6.3
450	6.9
500	7.2
550	7.8
600	8.0

the air and the surface according to equation 3 is:

$$(t_a - t_s)_m = \frac{85 - 64.5}{2.3 \log_{10} \frac{85 - 54}{64.5 - 54}} = 18.9 \text{ F}$$

The selected coil would have a surface area given by equation:

13. $A_a = \frac{H_s}{h_a (t_a - t_s)_m}$ or

$$A_a = \frac{87{,}000}{7.2 \times 18.9} = 640 \text{ sq ft}$$

where 7.2 is the over-all coefficient of heat transfer taken from table above, which correlates h_a and face velocity of air stream for the system under discussion.

The face velocity limits are those used in practice with the maximum not over 600 fpm. Best design would be 500 fpm, which we will use here. The over-all coefficients are for wet surfaces with moisture condensation that suits conditions. Required face area using a face velocity of 500 fpm is:

14. $A_f = \frac{Q}{v_f} = \frac{4000}{500} = 8.0$ sq ft

Cooling-Surface Depth. A coil having about 8 sq ft face area with a limiting face velocity of 600 fpm satisfies the job requirements. In addition, the coil's shape (number of rows deep) affects the dehumidifying efficiency of the system. As the depth of cooling surface increases more dehumidification is obtained with a greater slope of line 1 to 2 in Fig. 8. Various combinations are usually presented in manufacturer's data sheets in multiples of 2, 4, 6 and 8 row-deep coils.

Suppose that rating tables are not available, and a surface having the following characteristics is to be used:

Ratio of outside surface to face area	38.4
Ratio of outside to inside surface	9.8
Heat transfer coefficient, refrigerant side, h_r	200
Heat transfer coefficient, air side (table above)	
Face area (2-sq-ft multiples)	

The coil, whose characteristics were computed in equations 13 and 14, has a ratio of outside surface to face area of 80, but the surface under consideration has a ratio of 38.4 per coil or 76.8 for two sections deep in the direction of air flow. Because this is less than the required 80 and the face areas come in multiples of 2 sq ft final economical selection is a coil two rows deep with a face area of 8 sq ft.

Fig. 6 (in Part I) may be checked mathematically if the refrigerant temperature is calculated directly. The inside area of the coil may be determined from information at hand:

$$A_r = \frac{8 \times 2 \times 38.4}{9.9} = 62 \text{ sq ft}$$

The refrigerant temperature is

$$t_r = 54 - \frac{(135{,}300)}{200 \times 62} = 42.1 \text{ F}$$

This agrees closely with the 45 F previously approximated.

Here we would choose a condensing unit having a capacity of 135,300 Btu per hr at an evaporator temperature of 43 F, or slightly lower to allow for pressure drop in the suction line.

Telltales for Pressure Vessels

▶ MANY UNFIRED PRESSURE VESSELS are subject to corrosion or erosion, or both. Useful life can be extended by highly resistant materials or by thicker metal than needed to withstand working pressure safely.

In looking for evidence of corrosion or erosion, examine areas at (1) riveted joints (2) portions of metal that have been cold-worked and (3) heads designed with a short-knuckle radius where stresses may concentrate. Grooving points to active corrosion.

Corrosion on external surfaces can be seen if area is accessible. Only way to examine inaccessible surfaces is to expose them. If an area's condition looks dangerous, drill test holes to measure metal thickness.

As a precaution against failure, periodic inspection can be supplemented by drilling telltale holes in the metal wall. Most effective method is to drill holes into the plate from the surface opposite the one exposed to attack. Then corrosion or erosion opens the hole and allows the vessel's contents to leak out and warn the attendant. Never drill telltale holes too deep. Leave enough metal in the bottom to withstand working pressure safely. If there is any danger from leakage through the holes do not drill them.

If a leak develops in an unfired pressure vessel do not weld the hole, and put it back in service without thoroughly examining both surfaces. Someone may have drilled a telltale hole to warn of reduced thickness from corrosion or erosion. — *The Locomotive*

TWO 5000-KW AUTOMATIC EXTRACTION condensing units were converted to operate also as mixed-pressure units by replacing the check valve in the extraction line with a trip throttle valve. The turbine-inlet valves were drilled to pass 5000-lb-per-hr cooling steam through unit to the condenser when turbine is turning at rated speed but carrying no load

Rebuilt Steam Turbines Modernize This Twenty-Year-Old Paper Plant

To carry increased steam and electric loads at greatest overall economy, two automatic-extraction condensing turbines were easily converted to act also as mixed-pressure units. Flexibility and efficiency over wide load range feature new setup, which includes a large new noncondensing turbine-generator

By **G H SUHS**, *Chief Engineer, Sorg Paper Co*
and **R D McARTHUR**, *Turbine Specialist, General Electric Co*

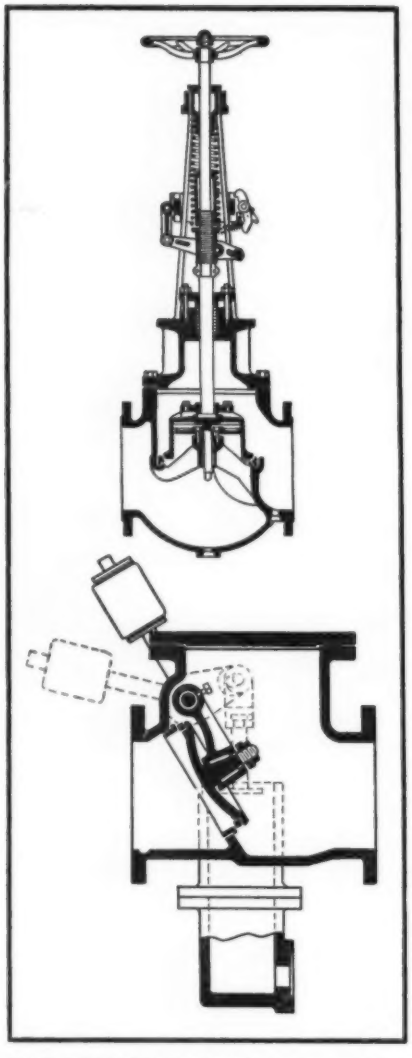
▶In 1928, THE SORG PAPER CO, Middletown, Ohio, installed two 5000-kw condensing automatic-extraction turbine-generators with three boilers to supply power and steam to its mill. At that time steam at 20 psig was used for drying paper. This product was largely a soft white paper, needing relatively little power.

The turbines were built for operation with 400-psig 700-F inlet steam, 2-in. Hg abs exhaust, automatic extraction at 20 psig and uncontrolled-extraction of small steam quantities at about 80 psig. Original plant layout is shown on p 72, and the individual turbine performance curves on p 73. Original peak electric load with all six paper machines running was 3750 kw. One turbine could carry the load with the other unit acting as emergency standby.

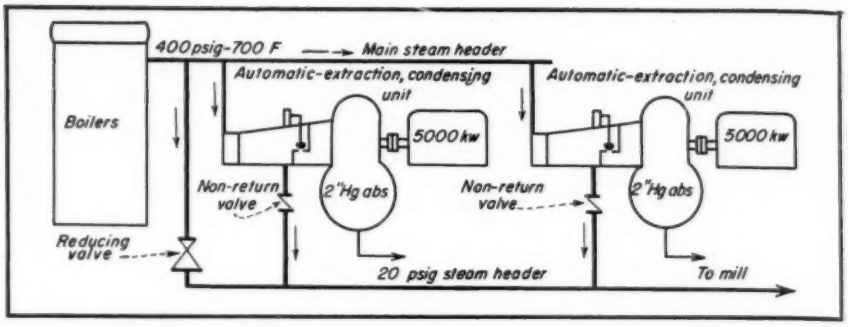
In its day this plant, one of the most progressive industrial power units built, had fully justified its design.

Growing Loads. Steam and electrical loads grew with passing time because of higher production and changes in paper type. Production increased from 30,000 tons annually in 1928 to 70,000 tons in 1946. Also, the paper machines were speeded up, needing more power and higher-pressure steam in the driers. At present, six paper machines use 9000 kw and the largest machine alone takes 3000 kw. Energy requirements often exceed 215,000 kwhr daily.

Additional boiler and turbine capacity were needed, so a study was made of alternate schemes. Steam at 600 psig was considered, but the gain was not enough to justify two plant pressures with increased design and operating complications. This probably would not be true if the original pressure had been 250 psig or less. A new boiler was installed in 1946 to produce



TRIP-THROTTLE VALVE, above, replaces the oil-tripped nonreturn valve, shown below, in the turbine-extraction line to allow the units to operate on mixed pressure



ORIGINAL PLANT LAYOUT featured two 5000-kw automatic-extraction condensing turbines which took 400-psig 700-F steam and supplied 20-psig steam to mill

120,000 lb per hr continuously at 400 psig and 700 F, burning pulverized coal.

The obvious addition seemed to be a new 7500-kw condensing automatic-extraction turbine alongside the existing units. But a study of steam and electrical loads showed that while the mill runs the steam demand is never less than 100,000 lb per hr. This suggested a backpressure turbine. Further study showed that a heat balance could not be achieved at all times without generating some condensing kw. Since the condensing power is always small, consideration was given to rebuilding the existing turbines to mixed-pressure operation. This could be done by simply replacing the positive-closing nonreturn valve with a trip throttle valve in the extraction line of each unit, sketch above. This allows either admission or extraction of low-pressure steam as demands require, top of next page.

Over the years, steam pressure in the driers had been raised from 20 to 40 psig; it may be raised to 50 psig later. The left-hand performance curve, at bottom of p 73, shows maximum flow to exhaust of 40,000 lb per hr with an extraction pressure of 20 psig (35 psia). Flow through a turbine section varies directly with the absolute steam pressure ahead of that section. Hence, with 40 psig (55 psia) at the extraction opening, flow through the turbine exhaust section would be 63,000 lb per hr.

Adapting Condensers. Each condenser has 6000 sq ft of surface and handles 40,000 lb per hr of steam. With increased steam flow through turbine exhaust, condenser capacity had to be increased. An idea to replace the existing units with new, larger ones was discarded in favor of the following scheme. It was found that by raising circulating-pump speed from 690 to 870 rpm enough water could be furnished to each condenser to handle 60,000 lb per hr of steam. With 80-F cooling water an absolute pressure of 2 in. Hg could be maintained. This requires a 50-hp motor to replace the old 30-hp one. The higher cooling-water velocity not only increases heat transfer but helps keep condenser tubes free of silt.

Speed Governing. To benefit most from the high efficiency of the 7500-kw back-pressure turbine, as much steam as possible should be passed through it. To do this, frequency will be held by the new unit. The old 5000-kw turbine, running parallel with the 7500-kw unit, will hold the mill steam pressure (40 psig). Speed governor of the 5000-kw unit will be set to keep its high-pressure valves closed at frequencies above 59 cycles. Thus, these valves will ordinarily be closed.

First high-pressure valve to open and the grid-extraction valve will be drilled to pass a steam leakage of 5000 lb per hr, to ventilate or cool the turbine. The backpressure turbine will furnish steam to the mill up to either its capacity or the demand. If steam demand is greater than will pass through this turbine at the prevailing kw load, the reducing valve will furnish the balance and the condensing turbine will merely float, passing 5000 lb per hr clear through to the condenser. This cooling steam will not quite carry the no-load losses so there is no danger of runaway.

If, as will normally prevail, the kw load exceeds the power generated by mill steam, the control on the grid valve will open it to allow enough steam to pass through the backpressure turbine into the mixed-pressure turbine to the condenser to generate the needed kw. This arrangement will produce any kw demand from 0 to 12,300 kw and any mill demand from 0 to 210,000 lb per hr within the limits of the right-hand chart, bottom of page 73.

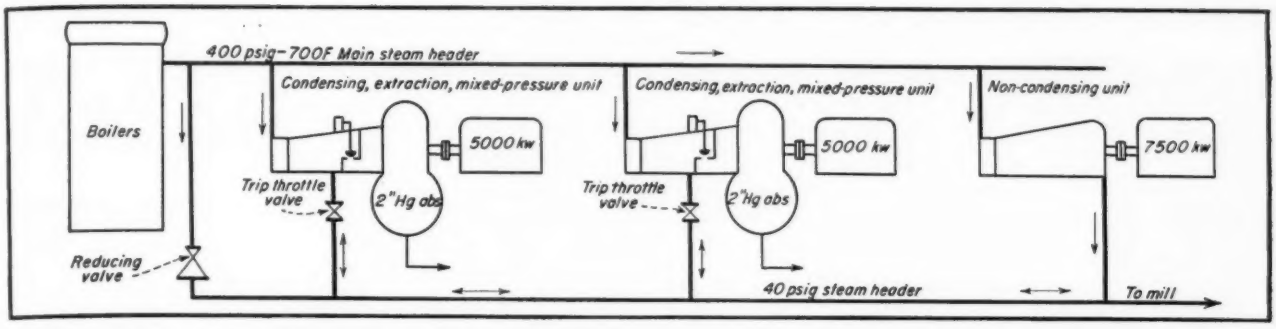
Speed governor on the backpressure turbine must govern over a kw range of 0 to 12,300 kw. This is 12,300/7500, or 164% of its rating. An ordinary

COST COMPARISON

7500-Kw Condensing Extraction and Noncondensing Turbines

Equipment	*Condensing-extraction turbine*	*Non-condensing turbine*
Turbine-generator.	$237,000	$220,000
Condenser and auxiliaries	50,000	0
Rebuilding old turbines	0	14,000
New cooling-water line.....	5,000	0
Total	$292,000	$234,000
Saving in investment	——	$58,000*
Annual fuel saving	——	$35,000

* Does not include (1) lower foundation cost for noncondensing turbine (2) lower cost piping layout (3) lower turbine installation cost.



MODERNIZED PLANT LAYOUT USES new 7500-kw backpressure turbine, old units as combined mixed-pressure and automatic-extraction turbines. Preferred operation passes all steam through new unit first, old unit's low-pressure end as needed

4% governor would give about 6% speed change for this load range. Therefore, this turbine is being equipped with a hydraulic speed corrector to keep speed changes within satisfactory limits (±0.1% for gradual load or flow change).

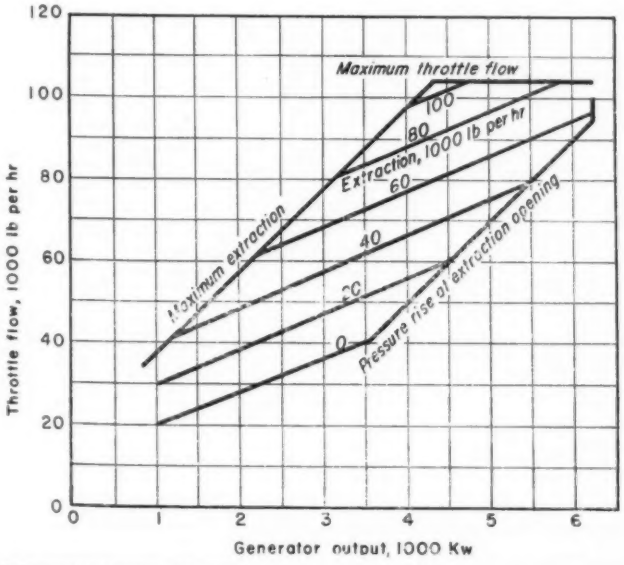
Pressure governor on the 5000-kw mixed-pressure turbine must govern for flow ranges far beyond its original capabilities. This control (1928 design) is being replaced by a modern design that will hold pressure within ±½ psi when flow changes are gradual. With these alterations it is expected that both speed and pressure governing will be successful.

Performance Comparison. Having determined that the turbines and condensers could be adapted easily, a study was undertaken of the economics of the alternate schemes. The turbine manufacturer furnished data on (1) the old turbines after rebuilding (2) a new 7500-kw backpressure turbine (3) a new 7500-kw condensing automatic-extraction turbine. Combined performance of a new 7500-kw backpressure turbine, operating in conjunction with one rebuilt 5000-kw condensing mixed-pressure turbine, was plotted in solid lines as shown in lower right-hand graph. Performance of a 7500-kw condensing extraction turbine, operating alone under the same conditions, is shown by the triangular points; 5000-kw unit performance is shown by the circular points.

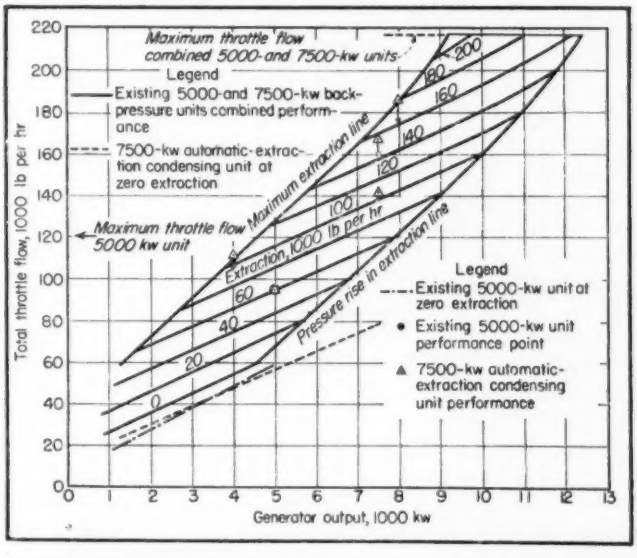
At all flows to throttle above 94,000 lb per hr the combination is best. If flows less than this prevailed, the kw load would be low enough so one 5000-kw turbine would be run alone anyway.

At 5000-kw 60,000-lb-per-hr extraction, performances of all these arrangements are identical. At high flows the combination arrangement shows as much as 20,000 lb per hr less flow for a given kw and steam demand. This is because the efficiency of a straight noncondensing turbine is so much greater than the head end of an extraction turbine. Fuel saving with this operation has been estimated at $35,000 per year.

Cost comparison of a 7500-kw condensing extraction turbine and the plan chosen is shown in the table at the bottom of p 72. The backpressure turbine is less expensive; also, no new condenser and piping are needed. A new condenser would have meant installing a new 200-ft 24-in. water line from the canal. The investment saving as listed is only partial. This figure of $58,000 does not take into account the lower foundation cost for a noncondensing turbine, lower-cost piping layout and lower turbine-installation cost. In addition to these advantages there is sufficient capacity to supply a new large paper machine when conditions warrant its installation.



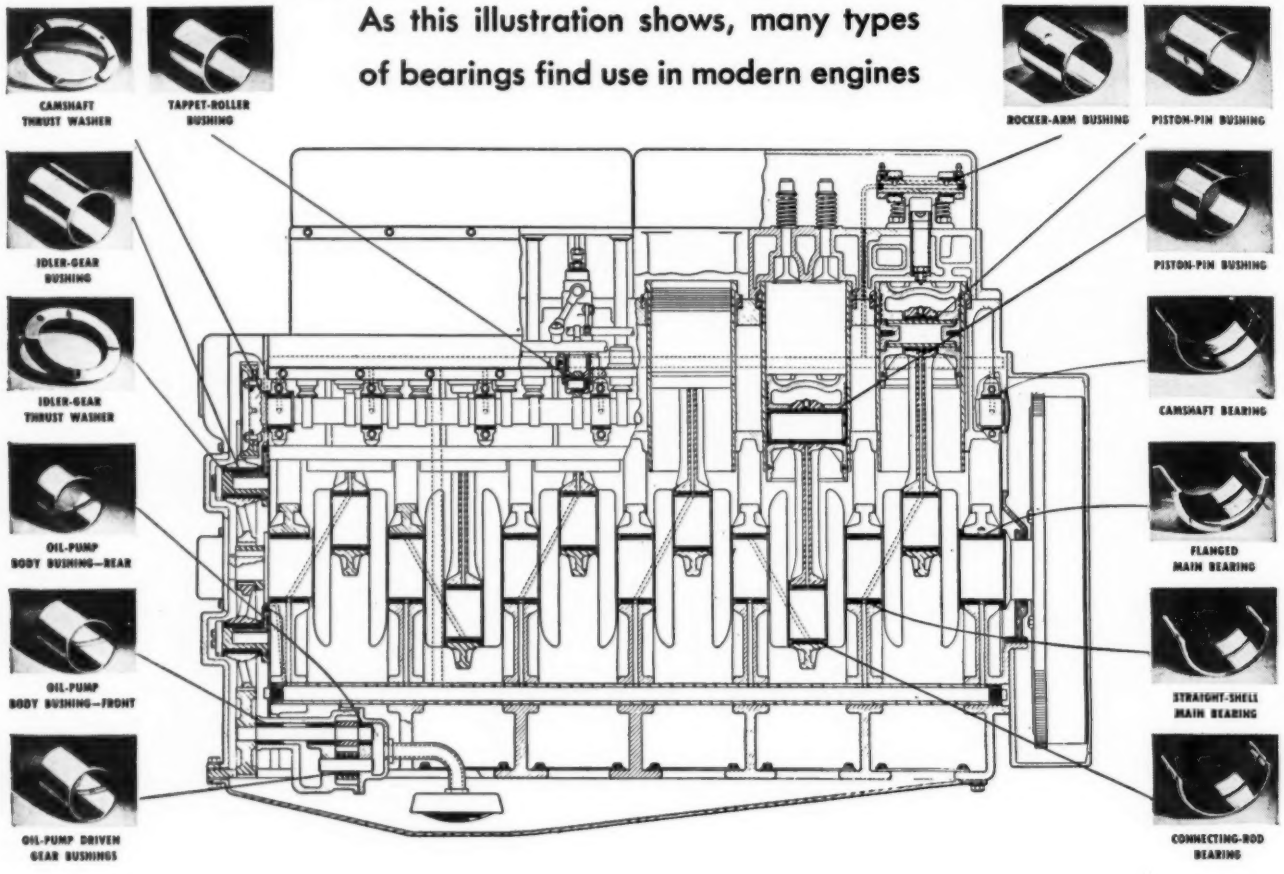
PERFORMANCE CURVES of the original 5000-kw turbines when operating with 400-psig 700-F steam and extracting 20 psig


Maximum throttle flow combined 5000- and 7500-kw units
Legend
Existing 5000- and 7500-kw back-pressure units combined performance
7500-kw automatic-extraction condensing unit at zero extraction
Maximum throttle flow 5000 kw unit
Maximum extraction line
Extraction, 1000 lb per hr
Pressure rise in extraction line
Legend
Existing 5000-kw unit at zero extraction
Existing 5000-kw unit performance point
7500-kw automatic-extraction condensing unit performance
Total throttle flow, 1000 lb per hr
Generator output, 1000 kw

COMPARISON OF PERFORMANCE CURVES shows superior efficiency for the combined operation at high steam-electric loads

TYPICAL BEARING AND BUSHING APPLICATIONS IN A DIESEL

As this illustration shows, many types of bearings find use in modern engines



Modern Bearing Materials Meet Tough

As new alloys and combinations of metals come into use, selection requires better knowledge of bearing requirements and properties of materials. Here are practical pointers on both*

▶ As engine speeds increase and bearing loads grow heavier, lining materials face ever more severe requirements. To meet these demands, original babbitts have been improved and new alloys developed. While the new materials are, in general, superior to babbitts in load-carrying ability, they are apt to be less tolerant of departures from sound design, accurate construction and good operation. Thus selection of lining materials is today an exacting job, requiring thorough understanding of what is required of a bearing in a given application and of the properties of bearing alloys.

Bearing Requirements. To prove suitable for bearing service an alloy must display: (1) adequate fatigue strength (2) good embedability and conformability (3) resistance to seizure (4) resistance to corrosion, and (5) if used as a lining, bondability. Let's look at each of these characteristics to grasp its meaning and assess its importance.

Fatigue Strength. Many rate fatigue strength as the most important of bearing-alloy characteristics. Failure from fatigue usually starts with cracks at the surface, which work downward well into the metal and frequently turn sidewards before reaching the bond. Such cracking finally results in detachment of pieces of the lining, known as spalling or "shelling-out." This in turn causes progressive failure of the bearing due to increased friction and overheating, resulting from disruption of the surface and consequent faulty flow of lubricating oil. The photos of fatigue failure on p 76 illustrate this.

It is hard to obtain a true picture of the relative fatigue strength of alloys because of the difficulty of duplicating service conditions. There is little similarity between the ordinary fatigue tests and actual bearing operating conditions. The closest approach to actuality would be a test by flexing—open-

* At the 19th National Oil and Gas Power Conference of the Oil and Gas Power Division, ASME, four comprehensive papers on bearings were presented by E Crankshaw and G W LaPier, Cleveland Graphite Bronze Co; B J Esarey, National Bearing Division, American Brake Shoe Co; W E Thill, Federal-Mogul Corp; and D B Wood, Aluminum Co of America. This article, and a preceding one (Jan, pp 84-87) is a condensation and free adaptation of these papers.

SERVICE CONDITIONS AND MATERIALS OF DIESEL BEARINGS

The following information regarding bearing applications in diesel applications will serve as a guide in selecting materials.

MAIN AND CONNECTING-ROD BEARINGS

In main and connecting-rod bearings, the journal is rotating and in almost all cases lubrication is sufficient so material selection depends largely on bearing loads. Within their load-carrying capacity, lead- or tin-base babbitts are preferred. As loads increase, higher-duty materials come into the picture. High-lead copper alloys have been used, but in such cases it is necessary to keep shaft hardness up to about 400 brinell. This reduces shaft wear substantially, particularly under abrasive conditions. With trimetal bearings—consisting of an intermediate layer of copper-lead, and a surface layer of precision-plated white metal—and aluminum bearings, it is found that such shaft hardness is not needed. This makes it possible to use high-duty bearing materials on large diesel shafts where heat treatment is not always economical.

ROCKER-ARM BUSHINGS

Although oscillating motion is inherent in rocker-arm bushings it has been found that tin- or lead-base babbitts are satisfactory for light loads. For medium loads, a 25% leaded bronze is often used, requiring a hard shaft. In highly loaded applications and in large diesels, it becomes necessary to revert to higher duty materials, such as 80% copper, 10% lead and 10% tin, with shafts of about 60 Rockwell C hardness.

PISTON-PIN BUSHINGS

High impact loading and, in many cases, limited lubrication have made it necessary to incorporate extremely hard piston pins as well as hard and high-load-carrying bearing material. Split steel-backed bushings lined with 80% copper, 10% lead, and 10% tin have almost entirely eliminated difficulty in these applications. In some cases, an alloy of copper, with 4% each of lead, tin, and zinc, is used as an alternate, particularly in smaller diesels.

STARTER-MOTOR BUSHINGS

Because of intermittent operations and the possibility of improper lubrication, 25% copper-lead graphited split bushings have found wide use in starter-bushing applications.

OIL-PUMP BUSHINGS

Lubrication usually proves satisfactory in oil-pump body and driven-gear applications, and tin- or lead-base babbitts, along with aluminum bearing alloys, find use.

CAMSHAFT AND GENERATOR BUSHINGS

Because of rotating motion, light loads and ample lubrication, it is advantageous to employ the tin- or lead-base babbitts and aluminum alloys, although copper-lead alloys are sometimes being used.

Demands of Diesel Service Conditions

ing and closing the bearing—causing alternating tension and compression stress in the metal. Unfortunately for clear understanding, flexing of the bearing shell is not always the major cause of failure. It is, however, a contributing cause and sometimes the sole cause.

The tension stresses required, in addition to the normal compressive stresses, may result from the difference in rate of thermal expansion between the lining and the back. In a steel-backed tin-base babbitt-lined bearing a rise of 130 F can produce over 13,000-psi stress, higher than the yield point of any ordinary babbitt. Such tension stresses, plus the normal compression, may open cracks in the surface.

Stress in lining material after casting on the backing is high and of the order of magnitude of the lining's yield point. When the bearing is subsequently heated to 150 F, stress drops to a small value because the high rate of creep relieves it. Cooling down to room temperature causes stress to return to a high value. Examination of operating conditions shows that during starting and initial running before the bearing warms up, tensile stresses will be high but they become small when the bearing runs warm.

It has also been shown that cracks indicating incipient fatigue failure can be produced by alternate heating and cooling of a portion of the lining surface through relatively few cycles. In early fatigue failure, the bearings often show signs of excessive localized heating of the surface.

Today's clearer picture of fatigue-failure causes has influenced the trend to thinner linings. Reducing thickness of the lining does not prevent the stresses but it does decrease their size.

Embedability. Inevitable presence of dirt in diesel engines demands that bearings display embedability. Requirements vary greatly from engine to engine, and with geographical and climatic conditions. Where oil and air filtration are employed, the variation is less and tends to depend mostly on filtration effectiveness.

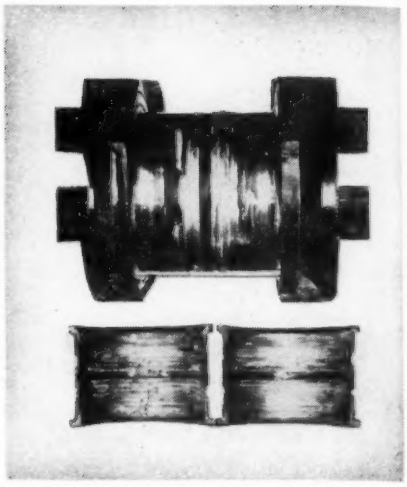
When dirt enters the bearing clearance space, it must embed in the bearing material or cut a groove around shaft or bearing. This should not be confused with the scoring resulting from insufficient anti-seizure characteristics. Confusion may be avoided by reserving the term "scoring" for the case just mentioned and using the term "cut" or "dirt-cut" to refer to bearings grooved by dirt and foreign matter.

Conformability. If it were possible to construct engines with complete accuracy and alignment, and if no distortions occurred in operation, the conformability of a bearing material would have little or no importance. Actually, of course, firing loads and other oper-

SOME TYPICAL DIESEL-ENGINE BEARING FAILURES

EXCESSIVE DIRT in the engine assembly or in the lubricating oil caused rapid shaft wear and this bearing failure

FATIGUE FAILURE shown here resulted from overloading the bearing material. Note the typical condition of the surface



OIL-FILM FAILURE allowed metal-to-metal contact in this illustration. Resulting seizure caused condition shown

ating conditions distort engine structures. This may produce edge contact between bearing and shaft. Heat generated by the metal-to-metal contact may be sufficient to cause bearing failure. If the metal can conform, it adjusts itself to the new condition. Even if the bearing fails, ability to conform will often prevent shaft damage.

The qualities of embedability and conformability have been combined by Underwood as "deformability" and he lists bearing materials in increasing order of deformability as follows: (1) bronzes (2) silver and copper (3) aluminum alloys (4) copper-lead with tin or silver (5) thin babbitt overlays (0.003-in. or less) (6) copper-lead (7) cadmium alloys and (8) lead- and tin-base babbitts.

Seizure Resistance. More time has been spent testing bearing materials for seizure resistance than for any other property. Unfortunately, laboratory bearing-test rigs are so rigid and accurately made, to secure reproducible results, that interpreting their data in actual serviceability is extremely difficult. Such tests serve, however, to rank materials roughly and to eliminate those clearly unsuitable.

Seizure-resistance data can be of value when measured in periods of high overstress in actual engine service. If bearing engineers and users could compare notes when seizure does occur, it would add greatly to our knowledge. Unfortunately a crankshaft is damaged in the process and since the information applies to only one engine it is expensive knowledge to obtain.

On the basis of seizure resistance of an actual bearing in an engine, without any overlay of lead-tin for "run-in," Esarey ranks the materials during periods of overstress as follows: (1) lead-base babbitt (2) tin-base babbitt (3) copper-lead on steel back (4) centrifugally cast tin-lead bronze (5) silver with small additions, electro deposited (6) cadmium-silver (7) copper with small silver additions. Gridding the surface and filling it with babbitt and providing a lead-tin run-in surface markedly improves seizure resistance of silver, centrifugally cast lead-bronze and copper-clad steel-back bearings.

Corrosion Resistance. Studies of corrosion resistance bring out the point that nearly all bearing materials can be corroded by some set of conditions, depending on type of acid and temperature. In general, operating temperatures and changes in oil conditions of present-day engines are such that bearings with a lead-tin or lead-indium overlay give satisfactory corrosion resistance, or have this resistance as an inherent characteristic. Originally developed as a run-in surface for silver bearings in aircraft engines, the lead-tin and lead-indium overlays provide complete coverage of bearings for surprisingly long service periods.

Bondability. Ability to obtain consistently strong bonds between lining and back is largely a matter of carefulness and manufacturing procedure if suitable materials are used. With modern methods in which the human element is removed as much as possible (for example, by centrifugal casting under electrical control) good bonds result consistently. The Kolene process for steel or cast-iron backs gives perfectly satisfactory bonds if care is taken to follow the instructions. Ability to obtain strong chemical bonds permits the present-day elimination of dovetails and other mechanical bonds.

Over-all suitability of a material for bearing service may be summed up as *wear resistance*, defined by Gillett, Russell and Dayton as "the resultant of fit and finish, seizure propensities, behavior with grit, corrosion resistance (formation of corrosion products that are wiped off shows up as wear) and strength and hardness. It is vastly affected by how the bearing is operated as to temperature, nature of loading and cleanliness of oil, and especially the relative number of stops and starts, that is the opportunity for seizure."

Babbitts. Invention of babbitt metal as a lining for bearings represented a tremendous advance. In general, we can still say that within their strength limits, babbitts are acknowledged the best bearing materials. They are tolerant of dirt and work well with all normal types of shafting material. They endure insufficient or intermittent lubrication and considerable distortion. Tin-base babbitts are well known, and have enjoyed general usage in perhaps more varied applications than any other lining material. High-lead babbitts, the general substitute for tin babbitts because of tin shortages, comprise several general groups differing mainly in the minor constituents added for hardening. Tin-antimony, silver, arsenic and alkali earths are used.

When babbitts are stressed or pounded too heavily, they fail in fatigue. Thus it has proved necessary to develop stronger materials to meet more severe demands. In general, these

stronger alloys require harder shafts, more and cleaner lubricant, better journal-surface finish and greater constructional accuracy.

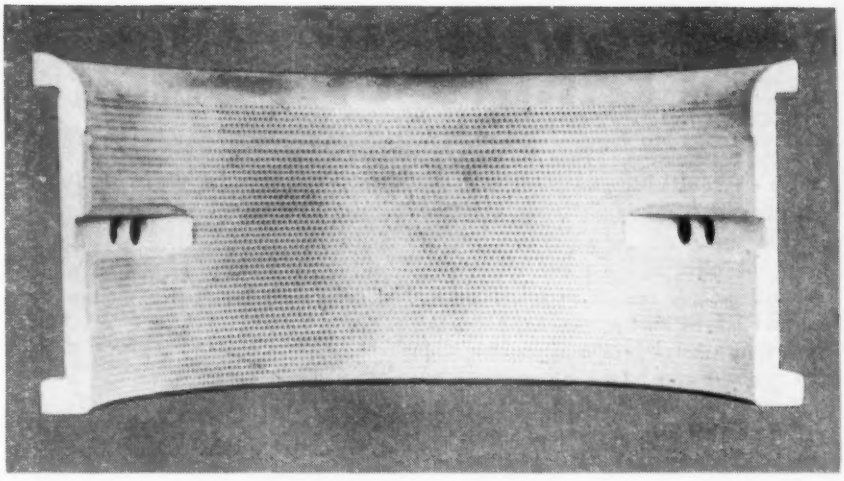
Lead-Bronze Bearings. Several general groups of alloys have found application as bearing linings where loads are too high for babbitts. One group comprises the lead bronzes, with 18 to 22% lead added to the copper-tin alloy that is bronze. Development of centrifugally cast lead-bronze came about just before the war period when steel tubing became increasingly short in supply. It was believed that a material of good conductivity and uniform throughout would eliminate the weaknesses of a bonded bearing and lead-bronze seemed suited for the job. Good results were obtained.

To extend the life in heavy-duty service, lead-bronze bearings were gridded, that is, the bearing surface was indented and filled with silver-lead babbitt. It was found that shape and depth of indentations, and relative proportion of gridded area to parent metal are not critical. Economical manufacturing methods were developed for gridding. It improves embedability, provides conformability and removes need for hardening the shaft. In periods of great overstress the babbitt melts out of the grooves to form a running surface and prevent seizure. Addition of an 0.002-in. run-in surface of electroplated lead-tin further improves seizure resistance and increases corrosion resistance.

Copper-Lead Alloys. Some mixtures of copper and lead have been used as bearing materials for some years and are by the nature of their structure suited for high loadings. A sacrifice in conformability and the need for a hardened or treated shaft of 300 brinell or harder are characteristics of these bearings.

Where soft shafts must be used, or where extremely high speeds are met, only the white metals will serve. It is also known that load-carrying ability of white metals, their weak point, can be increased by decreasing lining thickness drastically. This led to the so-called micro bearing, with a few thousandths of babbitt on a steel back, and the trimetal bearing, with a steel back, an intermediate layer of leaded bronze and a surface layer of babbitt.

Cutting the babbitt thickness to about 0.001 in. in thickness and using a copper-lead intermediate layer permits still further increase in load-carrying ability. The steel back and intermediate layer are formed and machined, complete to precision limits. The surface layer of white metal is precision plated so no further machining is required.



GRIDDED BEARING is made of lead-bronze, in one piece. Surface indentations are filled with a silver-lead babbitt. This construction improves the embedability and conformability, and eliminates the necessity for hardening the shaft, journals

In the early days of such bearings there was some concern about operating on the intermediate copper-lead layer after the plated white metal had disappeared. Considerable experience proves that the soft overlay adjusts itself to off-conditions of assembly and distortion so that when the overlay goes the load is carried over the entire length of the bearing with resulting satisfactory performance.

Other Lining Materials. Cadmium linings, of which the popular alloys are cadmium-silver copper and cadmium-nickel, are capable of high loadings. They require a minimum shaft hardness of about 250 brinell. In this connection shaft surfaces should, in general, be as hard as possible, regardless of the lining material. Since hardnesses above those normal to customary shafting materials involve heat treatment or other special processing, they present problems to the engine manufacturer. It is thus desirable to hold shaft hardness to the minimum consistent with the all-round requirements of the engine application.

Wartime requirements popularized silver, bonded to a steel back, for high-load-carrying bearings in aircraft engines. A plated run-in surface of lead-tin or lead-indium is required to provide satisfactory performance. Since dirt is an enemy of such a hard bearing material, even with an overlay, this material is not normally recommended for diesels, where service conditions are apt to be severe.

Aluminum Bearings. Considerable interest attaches to the recent development of bearings made of aluminum alloyed with tin and other minor additions. Most builders have tested or are testing such materials and at least one manufacturer is using aluminum-alloy bearings in a commercial engine. The alloy on which most work has been done consists of commercially pure aluminum with a 6.5% tin, 1% copper and 1% nickel. Another alloy, having the same composition except for the addition of silicon, shows improved resistance to scuffing and has been released on an experimental basis. Both alloys may be given a stabilizing heat treatment after casting, or may be cold-worked. The cold-working improves load-carrying ability. The alloy with silicon is recommended only where shaft hardness is over 300 brinell and can be used to advantage where doubtful lubrication conditions exist.

Aluminum-alloy bearings are normally fabricated from a single piece of material—the mono-alloy construction pictured in last month's article. Such bearings seem to have high load-carrying ability, good embedability and conformability, high resistance to seizure and corrosion. The inherent good heat-transmitting ability of aluminum should result in lower temperatures.

On the other hand, aluminum has a relatively high coefficient of thermal expansion, and ample room-temperature oil clearance must be provided. Clearance should be at least 0.001 in. per in. of journal diameter and preferably 0.00125 in. per in. Clean and positive lubrication are desirable in any bearing operation, but for best results with aluminum alloys special care should be taken to insure a clean engine at the start and positive lubrication.

SPEAKING OF POWER

We are constantly plagued by the odd bits that come our editorial way and find no convenient resting place in a magazine dedicated, in the main, to serving a solid diet of useful technical information. These may vary from nuggets, picked up at engineers' bull sessions and in chats with men on the job, to glimpses of future developments gained in visits to the manufacturing plants and research labs of industry. They may result from our own editorial journeyings, from the wanderings of our correspondents in far corners of the world, or from the incessant stream of periodicals and publicity releases that flows across an editor's desk. They may range from fact to fancy, from items of significance to items that amuse. Regardless of source and nature, they disturb editors' tidy souls because they defy classification as articles, news, what have you.

Because our job is one of communication, we itch to pass them along, and with them some of the sidelights of publishing a magazine which, like running a power plant, has its interesting, embarrasing and often humorous moments. So we herewith revive two war-suspended franchises, roll up the former "Speaking of Power" and "Exhaust Lines" columns into one, and bring you a page in which we "speak of power"—power, the engineering field, and POWER, the magazine. May it add the spice of zest and humanity to the meat and potatoes of practical information.

★ ★ ★

Best of the continuing crop of atomic-bomb stories is the one quoted by Bennett Cerf in *The Saturday Review*. High on a bluff near Los Alamos, New Mexico, an Indian was sending a smoke message when the experimental bomb went off. Crawling out of the ditch, he pulled himself together in time to see a tower of smoke billow into the sky. He watched in awe-stricken silence, clucked his tongue, and murmured, "I wish I had said that!"

★ ★ ★

Some twenty years ago the French physicists, Georges Claude (inventor of the neon lamp) and Paul Boucherot, proposed generating power by using the temperature difference between the warm surface of the tropical ocean and the cold waters of the deeps (POWER, March 1, 1927, p 329). Such a plant was built on a 10,000-ton cargo vessel and tested (POWER, Oct 28, 1930, p 702 and Jan. 6, 1931, p. 35) but failed to produce enough output to drive the pumps.

The controversy that raged over this experiment is likely to be revived if plans revealed recently by the French Embassy in New York materialize. These envision a 2-million-ton ship with a 65-ft-thick hull of a special concrete including sawdust and glass fiber. Proponents of the scheme claim that this colossal floating power plant, if anchored off the coast of Dakar, would supply energy enough to operate the Trans-Sahara Railway and irrigate parts of the desert.

★ ★ ★

Handling subscription records for magazines of large circulation is, of necessity, carried out on an essentially mechanical and impersonal basis. Such systems work with truly astonishing efficiency, but when the machine slips the results range from the merely annoying to the ridiculous. Thus when the Purdue chapter of Pi Tau Sigma, mechanical-engineering honorary fraternity, recently entered a subscription to POWER, the letter of acknowledgment was addressed to "Dear Mr Sigma." Purdue alumni By Sawyer and Bill Paisley, of the POWER business staff, spotted a kidding reference to the incident in the Purdue *Exponent*, were properly redfaced, took small comfort from the fact that dignity was maintained and "Mr Sigma" was not greeted with a familiar "Hi, Pi."

★ ★ ★

At the end of 1947, Allis-Chalmers Mfg Co, of Milwaukee, completed 100 years of engineering and manufacturing achievement. It was back in 1861 that Edward P Allis acquired the 14-year-old French burr millstone firm of Decker and Seville and initiated the still-held policy of diverse manufacture that was to lead to the world's largest line of major industrial products.

Old timers in the power field will remember Edwin Reynolds, whose engineering genius was responsible for such pioneering developments as the improved Reynolds-Corliss engine, the first direct-acting metallic-valve blowing engine, the first triple-expansion pumping engine of the inverted type, and the screw pump, forerunner of the propeller-type hydraulic turbine developed in more recent years.

The present Allis-Chalmers was formed in 1901 after merger of the Edward P Allis Co with Fraser & Chalmers Co, the Gates Iron Works and the Dickson Mfg Co. In the years after the turn of the century, Allis-Chalmers built many notable engine-generator sets, including the 3000-kw Reynolds-Corliss unit that powered the spectacular lighting of the St. Louis Fair of 1904. In March 1906, the first A-C steam turbine went into operation at the Kent Avenue Station of the Brooklyn Transit Development Co. Following years saw extension of electrical-manufacturing lines, continuous development of hydroelectric equipment and pioneering activity in the gas-turbine field.

★ ★ ★

In an effort to reduce Italy's foreign fuel requirements, the government minister for industry and commerce has asked the Fiat Co, at Turin, to investigate the possibility of replacing all steam and diesel machinery in their power plants with gas turbines burning natural gas.

THIS MONTH'S COVER

Power readers, as evidenced by continuing correspondence, well remember W A Doran's chronicles of the OLD CHIEF, his shrewd and lovable mentor in stationary engineering. No small part of this pleasant memory is the series of warmly human sketches made by Theodore Van Gorp, artist in the McGraw-Hill Illustration Dept. Others illustrated the early stories but it remained for "Van" to breathe life into the OLD CHIEF and sundry other plant characters – convivial Red Hogan, Old Bob, the blacksmith, Creeping Jimmy, Greenhouse Gertie, and that "honest" grafter, Boss Hookem.

Like all good craftsmen, Van is versatile. The brush that made the old plant and its denizens come to life can, with equal skill, dramatize the mechanisms of power engineering. For the February cover, we wanted a single, graphic symbol of the clutch, essential power-transmission element described in the special section beginning on p 79. Van found it in the simple and familiar jaw clutch, as his cover painting testifies.

Industrial-Power CLUTCHES

By
F A ANNETT
Associate Editor

Clutches for industrial-power drives are probably more popular than ever before. Accordingly, every power and industrial engineer should understand their use in the solution of power-application problems in group and individual drives. To assist him, this special section, POWER'S 66th, describes applications, constructions, operations, and characteristics of manually and automatically applied power takeoffs, lineshaft clutches and clutch couplings, including magnetic and hydraulic drives

Applications

Application of an electric motor to a machine or group of machines includes selecting a suitable motor, a speed controller or starter, and a connection to the load. The latter may require one or more couplings, shafting, hangers and bearings, belts, chains, gears, variable-speed transmissions, clutches, or combinations of these equipments. For many drives, either individual or group, clutches improve machine performance and simplify power applications. This is also true of internal-combustion engines.

Clutch Designs. Clutches and clutch couplings are built in many forms. Some are not true clutches, but are included to give an over-all picture. A clutch may be considered as a coupling that readily connects two working parts—usually a power source to its load—or releases them if desired. When these devices are in proper working condition, input and output shafts have the same speed, but they generally slip when severely overloaded. Other equipment applied as clutches permits 2 to 4% speed slip between power unit and driven machine. These are often used as variable-speed drives.

Friction Clutches. These form by far the largest group and have the widest use of any equipment classed as clutches. They are normally engaged and disengaged at full speed under load and, when properly adjusted, drive their loads without slip unless heavily overloaded. They may be applied either manually or automatically and are built in many designs. But all transmit torque by friction between two or more surfaces, held in contact under pressure. Other friction-clutch designs are marketed under different names derived from the means of engaging and disengaging them, such as those actuated by compressed air or pressure liquids, p 86.

Friction clutches are built to apply as cutoff couplings or as lineshaft clutches. In the former applications, they serve to connect a power source to its load or as a disconnect coupling between the halves of a lineshaft, Fig. 1, p 80. In this design the shaft end of left-hand half of the coupling is supported on a ball bearing, *B*, in the right-hand half, to maintain good alignment between the two.

Lineshaft Clutches. For drives like Fig. 2, the clutch is located on a lineshaft where power is taken off to drive a machine, or on a countershaft driving a group of machines, or for similar applications. One half of the clutch has a long sleeve that extends along the shaft. In Fig. 2 the sleeve supported on two ball bearings, *B*, permits the shaft to turn freely in this half of the clutch when it is disengaged. A pulley, sheave, chain sprocket or gear mounted on the sleeve drives the load while the other half of the clutch, keyed to the shaft, engages the pulley half.

Power Takeoffs. Clutches, built in as part of gasoline engines to permit them to start before applying load, are known as power takeoffs, Fig. 5. But a clutch, to connect an electric motor to the end of a lineshaft or to the driven shaft of a machine, becomes a cutoff coupling.

Friction-Clutch Applications. Among their many applications, friction clutches in group drives either connect or disconnect single machines or groups. These machines are driven by a motor of less horsepower than

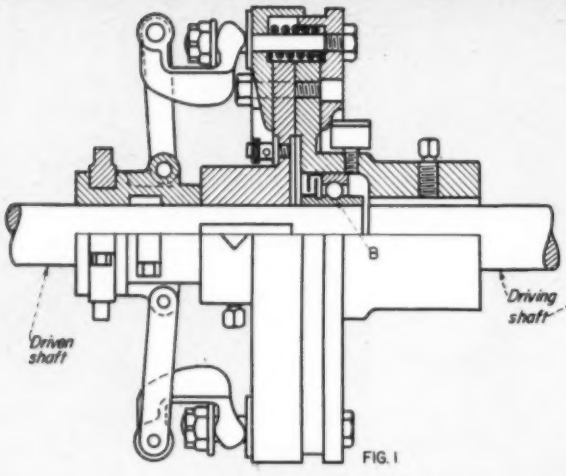


FIG. 1

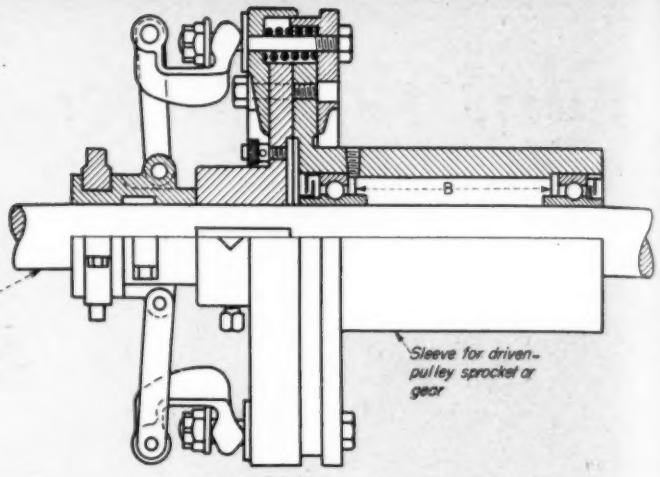


FIG. 2

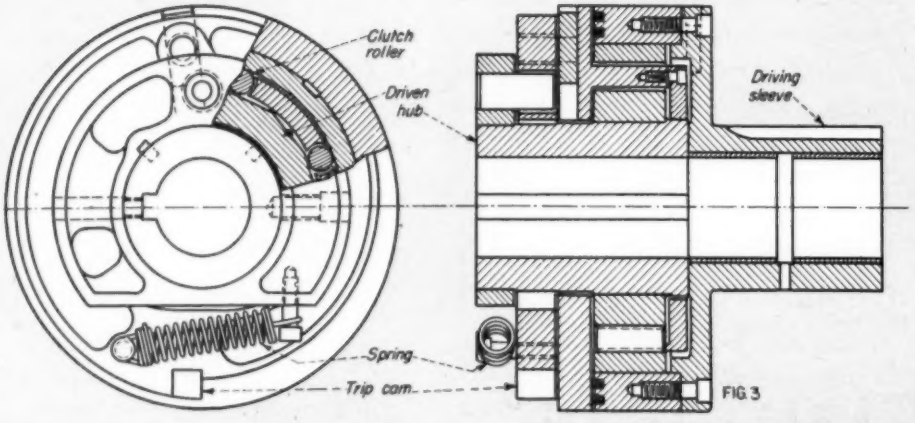


FIG. 3

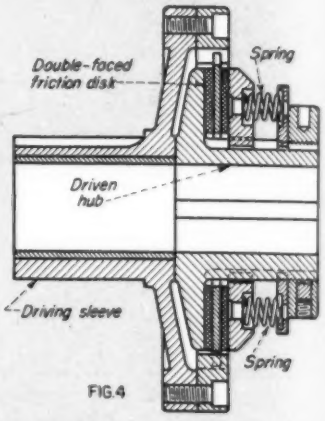


FIG. 4

FRICTION CLUTCHES: 1 Cutoff-coupling friction-disk clutch arranged as coupling between ends of driving and driven shafts. 2 Pulley design of friction-disk clutch takes power off lineshaft to drive one machine or a group. 3 Single-revolution clutch when engaged manually in machine operation makes one revolution, then is released automatically. 4 Slip clutch used instead of shear pins prevents damage to driven machine or power unit where there is danger of the load being stalled

the total required if each machine were connected to its own motor. Operating costs are generally less because the large motor, operating more closely to its rated load, has a better power factor and efficiency than a lot of small individual-motor drives.

Often where frequent load reversals are required—several times a minute, for instance—clutches do the job most economically. They permit the power unit to operate continuously at full speed in one direction, while they do the reversing. This service is severe and clutches should be selected accordingly. When power for starting a load is much greater than the running load, a clutch may permit a considerably smaller and lower-cost motor than if the motor were continuously connected to the load.

Clutches may also be an overload safety device between the load and its driving motor. When the load increases above a safe value the clutch slips to protect the driven equipment, as when a screw conveyor carries clay from a bin to a pug mill. Another slip-clutch application is on winding machines where fabric is wound off one mandrel onto another operating at constant speed, the two connected by a slip clutch.

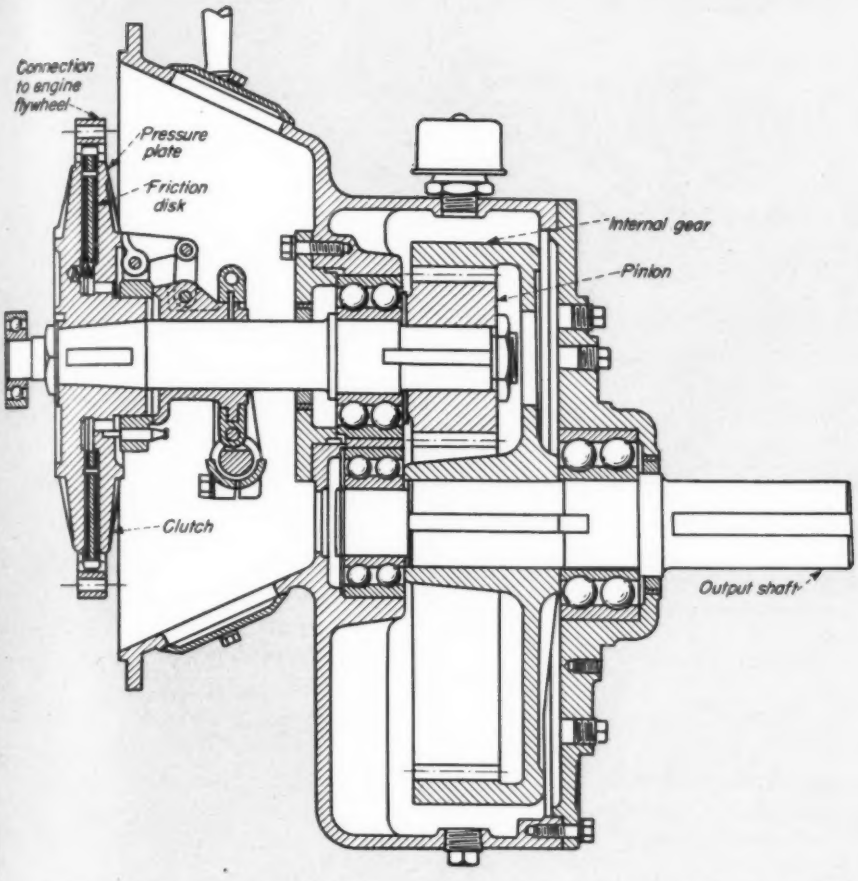
These applications indicate some of the conditions under which clutches are used. They have advantages also for high or low speed and for forward and reverse motions, or as a brake on many types of machines. They can be applied to either the driving or driven shaft through belt, rope, chain or gear.

Clutch Selection. Select clutches with due regard for operating conditions. The seven chief factors to take into account are: (1) horsepower to be transmitted (2) shaft speed (3) shaft size (4) available shaft length on which to mount the clutch (5) number of times clutch engages per hour (6) type of driven load; starting, running, shock (7) over-all drive requirements.

Generally the horsepower to drive the load, or the power of the prime mover, or both, are known. All manufacturers list the horsepower rating of clutches at 100 rpm, from which the size clutch for a given load can be determined when the other factors have been properly evaluated and the correct service factor applied.

Frequently shaft speed determines clutch design for a given application. The higher the speed, the more carefully a clutch must be balanced. One that operates satisfactorily at slow or medium speed might be unsuited for high speed. Speed also determines the sleeve that can be used on a lineshaft clutch. One manufacturer uses (1) wick-oiled cast-iron sleeves for speeds up to 450 rpm, (2) bronze-bushed sleeves between 450 and 800 rpm, and (3) ball-bearing for higher speeds.

Shaft Size. Manufacturers list standard and maximum shaft bores for each size clutch. These dimensions are a good check on clutch size because if its standard bore is much larger than the shaft on which it is installed, the shaft may be too small for the power transmitted, or the clutch too large.



POWER TAKEOFF: 5 Clutch, built as part of gasoline engine, permits it to start before applying load; known as power takeoff. But a clutch, arranged to connect and disconnect an electric motor to and from end of lineshaft, or do the same on driven shaft of machine, is called a cutoff clutch coupling even though both do about the same job

But power installations are sometimes made with oversized shafting. This may demand a larger clutch than the load requires.

Length of shaft on which the clutch is installed sometimes determines the type. Jaw, cone, internal- and external-expanding clutches require less shaft space than do other designs.

Number of engagements that a clutch makes per hour determines how hard it will be worked. The clutch must start the load and bring it up to speed. During this time friction faces slip, which causes them to wear and heat. If the number of engagements exceeds 15 per hour select a larger clutch than otherwise.

Load Characteristics. In each class of applications, load characteristics are different. Often starting is light and the running load normal. But in other cases, starting conditions are severe, or the running load may impose heavy peaks or shocks on the clutch. A shock load requires a clutch larger than for normal starting and running conditions. Shock loads include single- or 2-cylinder internal-combustion engines, punch presses, shears and similar equipment that require large power for a short time at either regular or irregular periods.

Other severe conditions include heavy starting and comparatively light running loads, as on machines with heavy mass that must be accelerated. Examples are tumbling mills, ball-and-rod mills and equipment with heavy flywheels, such as shears and punch presses.

Operating Conditions. Lastly, don't forget the conditions under which the clutch must operate. If the atmosphere is clean, dry and cool, clutch size may be determined by the factors previously considered. But, if atmospheric temperatures are abnormal, or dust, dirt, oil or chemical vapors are in the air they should be considered when selecting and installing clutches.

Don't forget that a properly selected clutch must be correctly installed and the shafting on which it operates kept in good alignment. Experience shows that a large percentage of all clutch troubles stem from misalignment.

Because of their importance in general power applications we have given considerable attention to friction clutches. Much of what has been said about their applications applies to other designs, particularly friction clutches engaged by any one of several methods.

Single-Revolution Designs. A single-revolution clutch, Fig. 3, when engaged manually in machine operation, makes one revolution and then releases automatically by a tripping mechanism.

An over-running or free-wheeling clutch remains engaged as long as the load tends to run slower than the power unit, but releases if the power unit happens to slow down faster than the load, p 90.

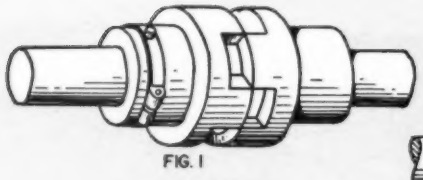
The slip clutch, Fig. 4, is used instead of shear pins where there is danger of the load being stalled. When this happens the clutch slips at a predetermined overload to prevent damage to the driven machine or power unit. Tension adjustment of a series of springs determines the torque at which the clutch slips. Other designs automatically trip free at a predetermined overload and are known as overload-release clutches.

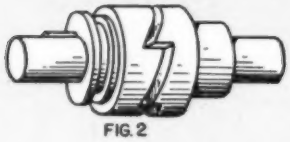
Automatic Clutches. Centrifugal or automatic clutches are in general friction clutches with some means, usually centrifugal, for engaging them as the power unit accelerates. When starting, the clutch remains released or partly released below a predetermined speed. As the power unit accelerates above this speed the clutch automatically engages, starts the load and brings it up to speed, p 87.

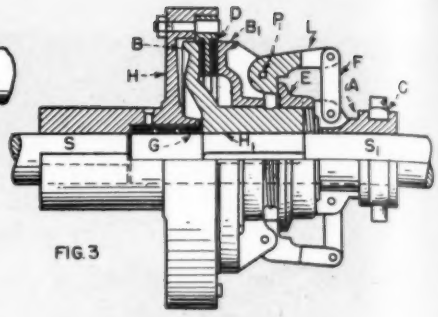
Magnetic Operation. A magnetically operated clutch, generally known as a magnetic clutch, is similar to a friction-disk clutch but is applied and released by energizing and deenergizing an electromagnet built into the clutch body. Friction surfaces are held together under pressure by magnetic instead of mechanical force, as in the conventional friction clutch. A more recent development in a magnetic clutch is commonly known as a magnetic coupling or variable-speed drive; it transmits torque as an electric motor does, p 91.

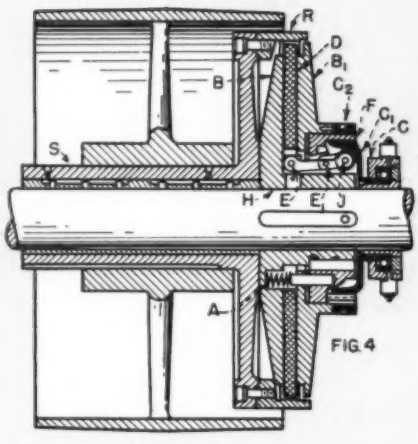
Hydraulic Couplings. A hydraulic coupling, sometimes used as a clutch, is partly filled with oil which the driving element pumps into the driven to run it as a turbine. This coupling, in addition to serving as variable-speed drive, also accelerates the load, like a friction clutch, after the prime mover has come up to speed, p 94.

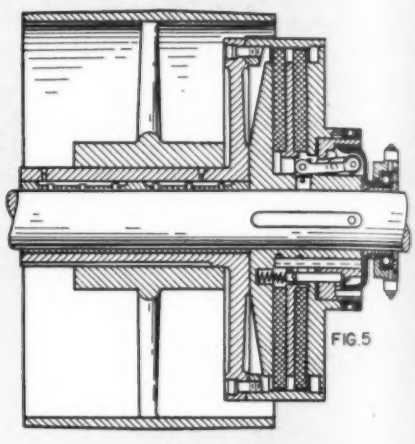
Clutch Types











JAW AND DISK CLUTCHES: 1 and 2 A square- and a spiral-jaw clutch, respectively, used for slow speeds. 3 Single-disk axial-operated cutoff coupling clutch with double-friction-surface disk. 4 Single double-friction-surface disk, axial-operated lineshaft clutch. 5 Multiple-disk lineshaft axial-operated clutch is used to increase power output for given diameter. This design has two double-faced friction disks

For many power applications it is advantageous and economical to provide means for readily connecting and disconnecting the driving unit and its load. Other application problems are simplified and costs reduced by accelerating a unit to part or full speed before applying its load. For these and other drive applications, clutches are used. They fall into several classes, but only manually operated jaw and friction designs are considered in this group. Later in this special section we will treat other types.

Jaw Clutches. The two general designs are square-jaw clutch, Fig. 1, and spiral-jaw, Fig. 2. The square-jaw usually has three jaws and the spiral-jaw, four. They are the simplest and lowest in cost but are quite limited in their applications. For cutoff couplings, one half of the clutch is keyed to the end of one shaft, and the other half is splined to the adjacent end of the other shaft.

These clutches are suitable for slow speeds where they can be engaged and disengaged when the lineshaft is at rest. If disengaged when the shaft is rotating, the load should be light to prevent over-stressing the jaws when they approach the disengaged position. When reverse torques are likely to occur use the square-jaw design because reverse rotation opens spiral jaws.

Friction Clutches. Available in a multitude of designs, friction clutches are operated pneumatically, magnetically or mechanically. They are also applied manually or automatically. Air-operated clutches are described on p 86, automatic designs p 87, and magnetic-operated designs on p 91.

Manually operated friction clutches have been developed in a great many forms, such as single and multiple disk, single and double-faced disk, radially operated, axially operated, compression, expanding, cone, coil, and others. All are built to apply as cutoff couplings, lineshaft clutches and power takeoffs. For a description of the different arrangements see "Applications," p 79.

Single Disk. Fig. 3 shows a single-disk coupling-type clutch. Disk D with its double-friction surface is bolted to flange H, the hub of which is keyed to shaft S. The clutching mechanism is keyed to shaft S_1, the end of which runs in a pilot bearing G in hub H, to insure alignment between the two halves of the clutch. The clutch is engaged by shifter sleeve A, which is free to move within its collar C. This collar connects to a lever by which sleeve A is moved axially to engage and disengage the clutch.

The friction disk runs between two metal surfaces, B and B_1. B is part of hub H_1; B_1, carried on the hub, is free to move axially under control of the operating mechanism. Levers L pivot on B_1 at P, contact adjustable collar E, and connect to sleeve A by links F.

The clutch is applied by moving shifter sleeve A to the left, which, through links F, forces the right-hand ends of L outward to turn them around pivots P. This produces a heavy reaction in levers L, pressing on adjustable collar E and friction plate B_1, to grip the friction ring between plates B and B_1. The clutch is released by moving sleeve A to the right to permit levers L to move a short distance toward the shaft. When the friction surfaces or other parts wear, adjustment can be made by turning collar E on its threaded connection with hub H_1.

Fig. 4 is a single-disk type, as is Fig. 3, but arranged as a lineshaft clutch. Sleeve S is free to rotate on a lubricated bearing on the shaft and connects to external driving ring R. On the inside of R are splines into which mesh teeth on the outer periphery of friction disk D. This arrangement permits the friction disk to take a free-running position between friction plates B and B_1 when the clutch is disengaged.

Hub H is keyed to the shaft and cast as part of friction plate B. Friction plate B_1 is moved axially by the operating mechanism, which is controlled by a lever attached to collar C, as in Fig. 3. A toggle mechanism connects to friction plate B at E and to the movable friction plate at E_1. To release the clutch, collar C_1 is pulled to the right by the operating mechanism, toggle joint J moves up-

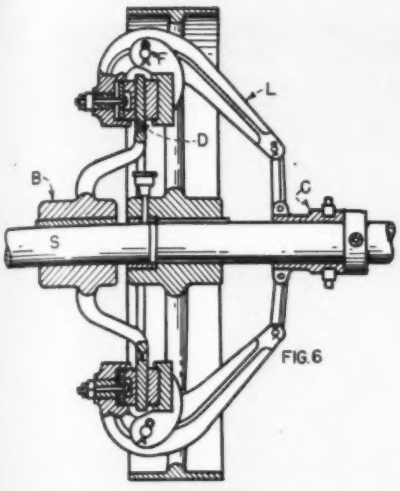


FIG. 6

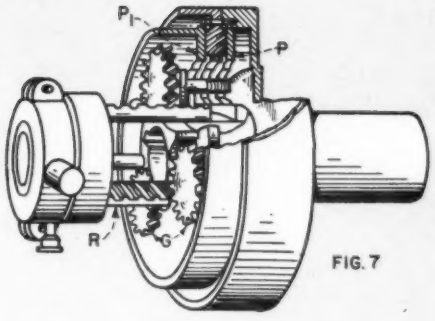


FIG. 7

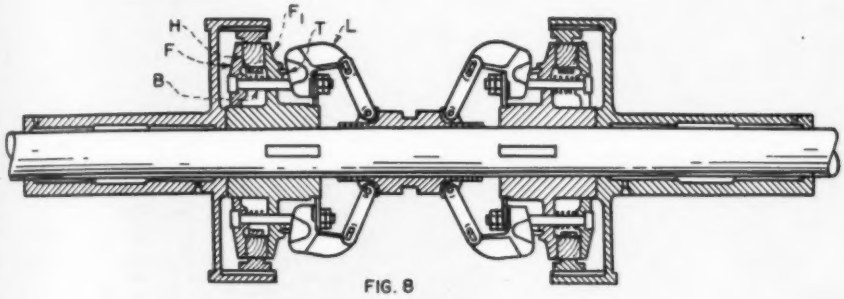


FIG. 8

SINGLE- AND 2-SPEED CLUTCHES: 6 Lineshaft cutoff-coupling clutch with wooden friction shoes built into pulley for flat-belt drive. 7 Single-disk axial-operated lineshaft clutch is applied and released by worm-and-gear mechanism instead of levers. 8 Duplex clutch is used for two speeds or with a straight and a crossed belt for reversing service from a constant-speed driving motor or other power source

ward to free friction plate B_1, and the friction disk is released by spring *A*. The reverse operation engages the clutch. Only one toggle mechanism and one releasing spring are shown in the drawing, but to insure equal distribution of pressure on the clutch parts, three or more of each are used. Adjustment of the clutch is made by collar C_2, threaded onto extension *F*.

Multiple Disk. A multiple-disk clutch, of the same type as the single-disk, Fig. 4, is shown in Fig. 5. This design has two double-faced friction disks with a pressure disk between. Friction disks have gear teeth that mesh into splines on the inside of the external driving ring. The pressure plate has teeth on its inner periphery that mesh into splines in the hub, so the disks are free to adjust themselves axially. This permits free running when the clutch is released and equal distribution of pressure on the friction elements when the clutch is engaged. Multiple-disk designs permit greater capacity for a given outside diameter than is possible with single-disk types. Some designs of multiple-disk clutches have seven or even more friction disks.

Cutoff Coupling. In the cutoff-coupling clutch, Fig. 6, a disk ring *D* is supported on arms from a hub *B*, keyed to shaft *S*. The friction element is faced with wood and supported within the pulley. Levers *L* are fulcrumed at *F*. Then, when the right-hand ends of these levers are forced outward by moving sliding collar *C* to the position shown, the friction element grips disk *D* to couple the two shafts together. Moving the sliding collar *C* to the left releases the clutch.

The clutch, Fig. 7, is applied by screws instead of levers. Three small gear wheels *G* have their stems threaded into the right-hand friction plate *P*. Rods *R* fixed in the operating collar carry teeth that mesh into the gears. When the operating collar is forced to the right, toothed rods *R* turn gears *G* to pull the friction plates *P* and P_1 together to grip the friction ring and engage the clutch.

Duplex Clutch. Where reversing drives or two speeds are required from a constant-speed power source, a duplex clutch, Fig. 8, may be used. For reversing service, an open-belt drive from the power source connects to a pulley on one clutch, and a crossed belt connects the power source to a pulley on the other clutch. For 2-speed service, the pulley ratio from the power source to one clutch is different from that of the other drive. In reversing service, the forward speed may be made different from the reverse speed by making the pulley ratios different.

Friction elements in the clutch of Fig. 8 are hardwood-block inserts *H*, held in an iron ring so end-grain surfaces come in contact with the surfaces of two iron friction plates. Bolt *B* connects the inner end of levers *L* to the free friction plate *F*, and a toggle *T* forms a fulcrum between *L* and friction plate F_1, cast to the hub. When levers *L* are forced outward as the operating sleeve is pushed toward the clutch, they draw the friction plates together to grip the wood-block friction element.

Expansion Types. Fig. 10 shows a cutoff coupling of the expansion type. Friction band *B* is forced out against the inside of drum *D*, which is keyed on the left-hand shaft. Hub *H* is keyed to the right-hand shaft, and carries one side of a vee that fits against the inside of friction band *B*. Right-hand side of the vee is carried freely on hub *H*, and is connected to the operating mechanism. When levers *L* are forced outward to engage the clutch, the cams on their ends force the right-hand side of the vee and friction band *B* to the left against the left-hand side of the vee, and band *B* is expanded against drum *D* to connect the two shafts.

A double friction-band clutch of the expanding type is shown in Fig. 9. Outer band *B* is forced out against a drum as in Fig. 10, and the inner band B_1 acts on ring *R*. The bands are applied by two cone-shaped rings that are forced between the bands by the operating mechanism. This design gives considerably greater capacity for a given drum diameter and length than does Fig. 10.

An expanding-type clutch, designed with the friction band in four sections or shoes but making practically 100% contact with the friction drum, is shown in Fig. 11. Wedges *W* fit between the ends of the friction shoes. These shoes, held in a released position by springs *S*, are applied when the clutch-operating mechanism forces wedges *W* out between the friction shoes, expanding them against the friction drum.

The clutch of Fig. 12 comprises drum *D*, central hub *H*, and expand-

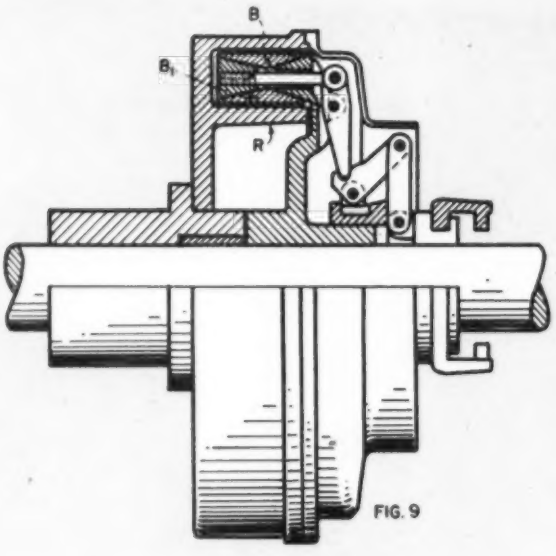


FIG. 9

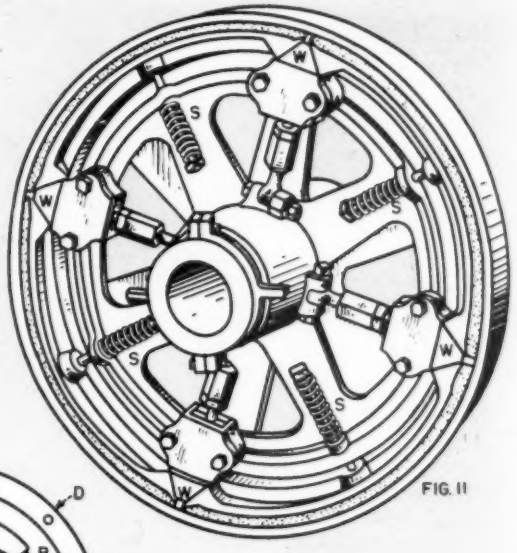


FIG. 11

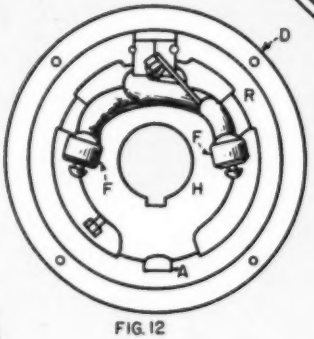


FIG. 12

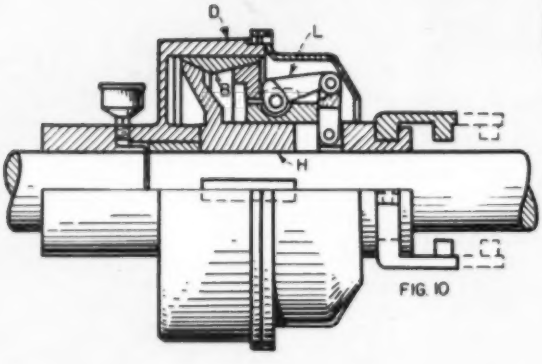


FIG. 10

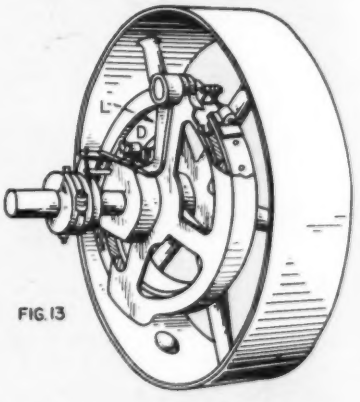


FIG. 13

CONE AND EXPANSION CLUTCHES: 9 Cutoff-coupling clutch of the double expansion type is arranged to apply the friction members radially by cone-shaped rings. 10 In this single-band radially applied friction cutoff-coupling clutch, band *B* is forced out against the inside of drum *D* by two vees. 11 This expansion clutch has a friction band made in four sections. 12 Engagement of this expansion clutch is by a cone forced between the ends of levers *F*. 13 Compression lineshaft clutch has a single friction band lined with wooden blocks which surround drum *D* cast on the spokes of the load pulley

ing ring *R*. This ring is fixed to the hub at *A* and is, therefore, driven by it. Engagement of the clutch is by a cone forced in between the ends of fingers *F*. At their upper ends, the fingers are so shaped that they expand ring *R* when their lower ends are separated.

Compression Types. Several compression-type clutches have been developed, in which the clutching element contracts on a drum, as in Fig. 13. In this design the pulley has drum *D* cast to its spokes. This drum is surrounded by the friction element, which is similar to a band brake with a wood-block lining. The clutch is engaged by moving lever *L* to the right, which causes the friction element to contract and grip drum *D*. The design shown is of the lineshaft coupling type, but these clutches are also arranged for cutoff-coupling service.

Lubricated Friction Elements. The clutch, Fig. 14, has quadruplex friction elements comprising pairs of self-aligning conical metal rings, each pair telescoping over the other with a wedging action by means of an axial force. This clutch is filled with oil, consequently friction surfaces are lubricated.

In the top half of the figure, the clutch is engaged, in the bottom half it is released. Friction rings connect to driving hub *H* and driver casing *C* by splines. Play in the splines permits adjustment of friction rings and also a slight misalignment between driving and driven shafts to protect them from severe stress and the bearings from overloads.

Pressure to engage the clutch is produced by an axial force, which is applied to operating ring *R*, and which through rods *S* causes the toggle mechanisms to move from the position in the lower part of the figure to that in the upper half. This action causes pressure plate *P* to force the friction rings together under a high pressure. When the pressure plate is released to disengage the clutch, the friction rings separate and release the two shafts. This clutch has been built in sizes up to several thousand horsepower.

Twin Cone. A twin-cone, cutoff clutch, Fig. 15, has drum *D* keyed to the left-hand shaft, and has a vee on its inner periphery. Left-hand friction surface *F* is part of the hub keyed to the right-hand shaft. Right-hand friction element F_1 connects to the toggle-operating mechanism and is free to move axially under its control. Operating levers *L* pivot at *P*, with their ends connected to the movable friction element and the operating mechanism by toggle joints. When the operating collar is moved to the left, as in the figure, levers *L* are forced into the position shown and the two friction surfaces brought into contact with the vee attached to drum *D*.

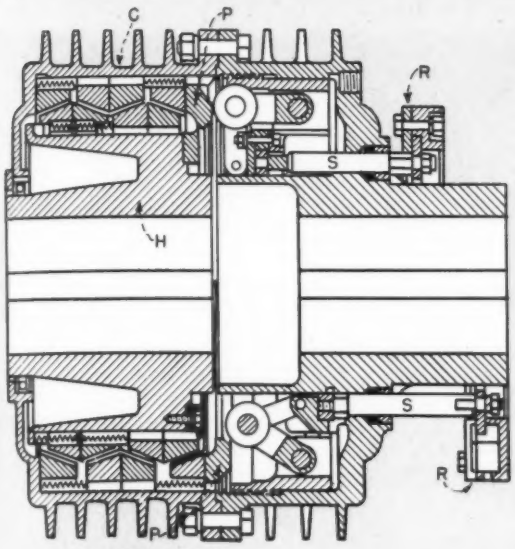


FIG. 14

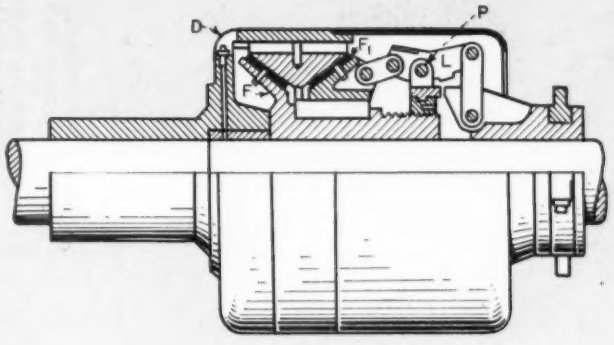


FIG. 15

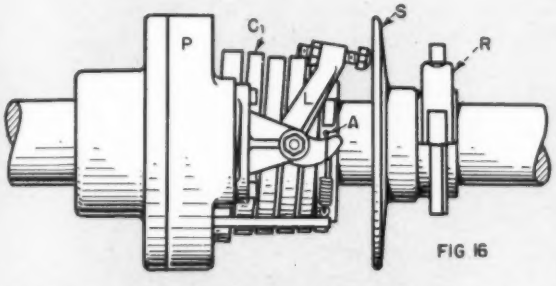


FIG 16

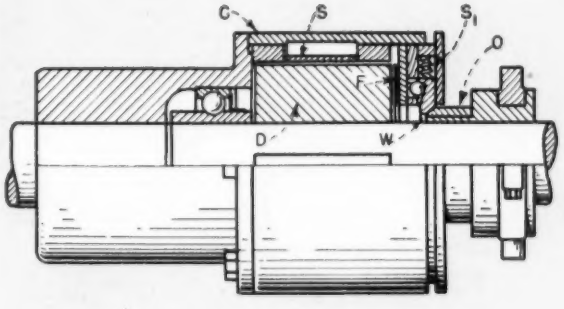


FIG. 17

TWIN-CONE AND COIL-SPRING CLUTCHES: 14 This clutch has lubricated quadruplex friction elements, comprising pairs of self-aligning conical metal rings, each pair telescoping over the other with a wedging action produced by an axial force. 15 Twin-cone double-friction element cutoff-coupling type clutch. 16 Tapered-coil-spring clutch is applied by gradually tightening coil C around a cast-iron drum. 17 Disk-actuated spiral-spring cutoff-coupling clutch is applied by tightening a flat-spiral spring S onto a drum D, by pressing sleeve O under wedge W to move it upward and force F against end of drum D

This engages the halves of the clutch.

Coil-Type Clutch. The coil-type friction clutch, Fig. 16, comprises three principal members: a drum, usually forming the driving member, coil *C*, and plate *P*, to which the coil is fastened. In the cutoff coupling, the drum is keyed to the driving shaft and plate *P* keyed to the driven shaft. The drum runs in a pilot bearing in plate *P* to insure shaft alignment. This drum is made of selected cast iron, chilled and polished, while coil *C* is carbon steel of high tensile strength. The cross-section of the coil tapers from one end to the other. Its small end or tail is free when the clutch is released, the large end being permanently attached to the plate of the driven member.

When the clutch is released, as in Fig. 16, sliding collar *S*, cod ring *R*, and drum inside the coil are free to rotate with the driving shaft. To engage the clutch, collar *S* is moved against the mushroom pin in lever *L*. The lower end of *L* connects to the small end of coil *C* at *A;* therefore, as the upper end of *L* is forced to the left, its lower end tightens the coil on the drum to engage the clutch. When the small end of the spring is brought in contact with the driving drum, it gradually tightens the coil until coil and drum become practically integral. When running released, coil and drum like any journal bearing must be lubricated. Clutches of this design have been built in capacities up to 8000 hp at 50 rpm.

Spiral-Spring Clutch. In the disk-actuated spiral-spring clutch, Fig. 17, drum *D* is keyed to the driving shaft and is free to rotate when the clutch is released. The driven part of the clutch includes casing *C* connected to a hub keyed to the driven shaft. Surrounding *D* is a flat spiral spring *S*, the left-hand end of which connects to *C* and the right-hand end to a friction disk *F*. When the shifter sleeve *O* is pressed under wedge *W*, it moves upward against the ball bearing and forces *F* against the end of *D*. As the friction disk turns with the drum, it tightens the flat spiral onto the drum, as a rope is tightened around a capstan, and the clutch is engaged to accelerate the load. When the operating sleeve is withdrawn to release the clutch, spring S_1 forces *W* down, and disk *F* is forced away from the drum. The ball bearing between wedge *W* and friction disk *F* permits easy operation of these parts.

In this clutch, practically all power is transmitted by the spiral spring, the sole duty of the friction disk being to contract the spiral to engage the clutch. A feature is small diameter for a given capacity. But like the design in Fig. 16, this clutch cannot be used for reversing service. When such a clutch is ordered, the direction of rotation must be stated.

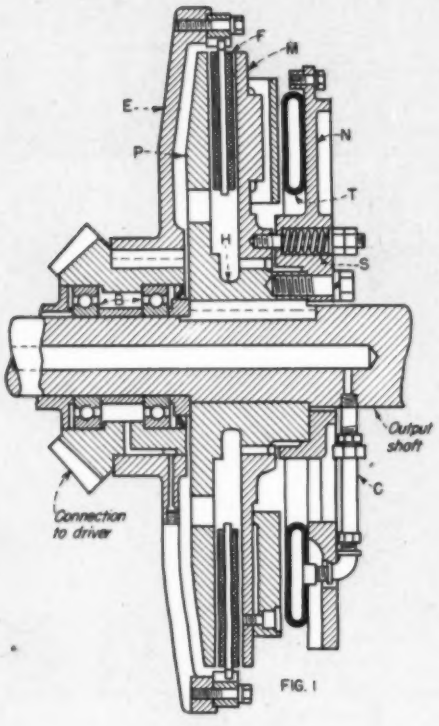


FIG. 1

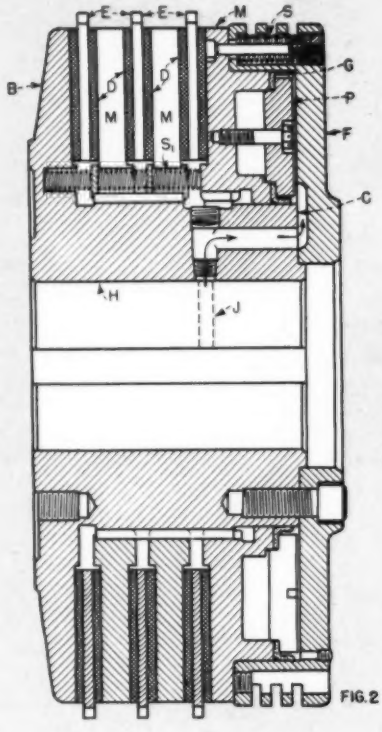


FIG. 2

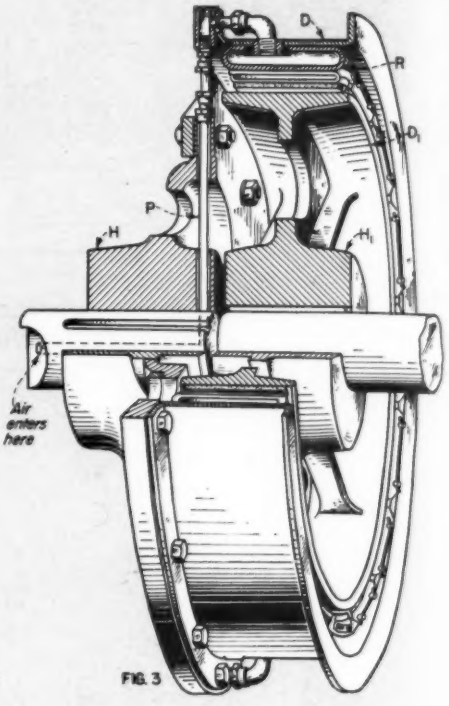


FIG. 3

AXIAL: 1 Conventional-disk friction clutch is modified for operation with air

RING PISTON: 2 Air pressure on ring piston applies this multiple-disk clutch

RADIAL: 3 One design of a radially applied friction clutch operated by air

Air Operation

Clutches operated by compressed air are coming into extensive use, particularly in the larger sizes. Some units are conventional disk clutches, modified for adaptation to air operation while others are special designs built around the air-operating mechanism.

Axial Application. Fig. 1 shows one of the former with double-faced friction disk *F* that makes a floating connection with input element *E*. When the clutch is released, this element is free to rotate on two anti-friction bearings *B*. Backing plate *P* and hub *H*, which form one piece, are keyed to the output shaft.

Movable plate *M* floats axially on splines in the hub. Between plate *M* and a fixed plate *N* bolted to the hub is expansion tube *T* that actuates the clutch. This circular tube, shaped like a flat doughnut, connects by a pipe *C* to the hollow shaft as shown.

Compressed air admitted through a metering valve and revolving seal enters tube *T* through the shaft. Air pressure expands the tube and forces movable plate *M* to the left to clamp the friction disk between it and backing plate *P*. Springs *S* pull movable plate *M* to the right to insure clearance on each side of the friction disk when air pressure is released.

Ring-Piston Operated. The multiple-disk clutch, Fig. 2, is applied by air pressure acting on ring piston *P*. The three double-faced friction disks *D* float on a splined connection to the power unit at *E*. When the clutch is released the friction disks rotate freely between backing plate *B* and movable plates *M*. *B* is part of hub *H* to which front plate *F* bolts. Piston *P* has a cup packing *G*, which seals it in its cylinder *C*.

To apply the clutch, air is admitted by an actuating valve that permits the operator to obtain and hold any air pressure up to maximum on the piston. Air enters the cylinder through the shaft's center and hole *J* in the shaft and hub, around to the right, in between the piston and front plate. Pressure acting on the piston forces it to the left to grip the friction disks and movable plates between the piston and backing plate.

Releasing the air pressure disengages the clutch, and piston *P* is forced to the right by springs *S* and S_1. The latter also equalize the running clearance on each side of the friction disks.

Radial Application. Fig. 3 shows one design of a radially applied air-operated clutch. The clutch element connects to an outer drum *D* and to hub *H*. The inner drum D_1 and hub H_1 are cast as a unit and keyed to the right-hand shaft. A rubber tube *R* forms the operating element, with the friction member between the tube and inner drum.

Rubber tube *R* connects to a compressed-air source through pipe *P* and a hole in the left-hand shaft's center. Admission of compressed air to the tube expands it radially inward to press the friction member onto drum D_1 to accelerate and drive the load. When air pressure is released from the tube, disengagement is complete, and the friction members are lifted clear off drum D_1 by flat springs.

These clutches are built in a wide range of capacities from a few horsepower to 2500 at 100 rpm. Air pressures range from 75 to 110 psi. They are also used for many different applications, for example, on compressors, blowers, fans, conveyors, paper-mill drives, ball mills and pulverizers.

Automatic Designs

To apply power units correctly, the load's starting, running and stopping requirements must be considered. In many applications, all three are normal and, therefore, offer no unusual problems. For example, a centrifugal pump requires a low break-away torque, has low inertia, is comparatively easy to accelerate, operates at practically constant load; when power is disconnected it gradually slows down and stops. A normal-torque across-the-line-start squirrel-cage motor and simple starting switch are ideal for small and medium-sized drives. There are many applications, such as on high-inertia and high-friction loads where such simple power equipment cannot be used, unless in combination with mechanical-power transmission devices.

Steel Shot Transmits Power. To permit the use of simple motors and control equipment on such jobs, several types of automatic clutches have been developed. In some way all depend on centrifugal force for their operation. One type, Fig. 1, is quite different from most designs: The member keyed to the motorshaft is essentially a 2-bladed paddle wheel. A drum that contains this wheel is keyed to the driven shaft. In this drum is a quantity of steel shot, about 0.02 in. in diameter, that forms the power transmitting medium.

When the motor starts, the shot is at first either thrown ahead of the paddles or slips by them. As speed increases, centrifugal force throws the shot out against the drum with increasing force, thus increasing the resistance between the driving and driven members, and the load accelerates. When it comes up to speed, the shot is distributed somewhat as in Fig. 2. Axial serrations on the inner surface of the drum help the shot resist the driving force of the paddles.

Slipring Starter. A clutch coupling known as a slipring starter is shown in Fig. 3. It has three elements: spider *S*, two friction bands *B*, and drum *D*. The spider is keyed to the motorshaft and the drum to the shaft of the driven machine. One end of each band is connected to an arm on the spider, by which it is pulled, the rear or trailing end of the band being free. As the motor speeds up, centrifugal force causes the bands to expand and exert a frictional drag on the drum. Torque transmitted depends on motor speed, diameter of drum and weight of the friction bands.

The slipring starter is inherently a limit-torque coupling. When applied to high-inertia loads with a motor just strong enough to handle the running load, maximum load may be kept down to 120% of the motor rating. When applied to conveyors where sudden running overloads or stalling of the motor may occur, the starter is built to transmit a maximum of 150 to 200% of motor-rated torque. If the conveyor stalls, the starter slips, allowing the motor to continue to run until tripped off the line by the overload device. In this way both conveyor and motor are protected.

Two Drum-Shaped Members. The automatic clutch coupling of Fig. 4 has two drums, one attached to the driving shaft, the other to the driven. Between driving and driven members are two sets of floating segments or friction shoes, usually of bronze reinforced with lead and faced with a brake lining. Shoe weight is varied to give the required friction-shoe pressure at rated speed to carry the load.

On the driving member friction shoes fit inside the outer drum of driven member. On the driven member they go inside the drum of the driving

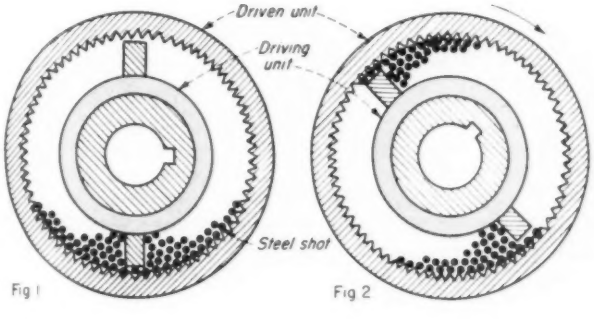


Fig 1 Fig 2

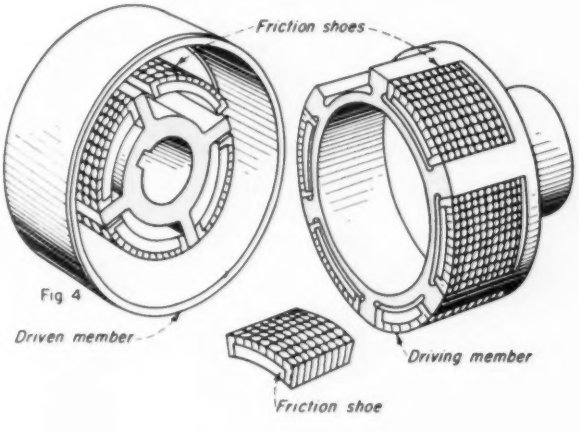


Fig 4

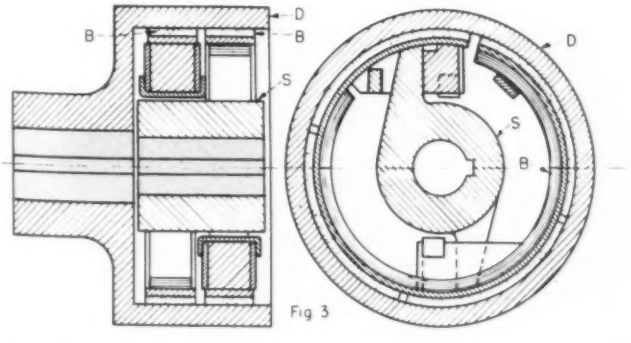


Fig 3

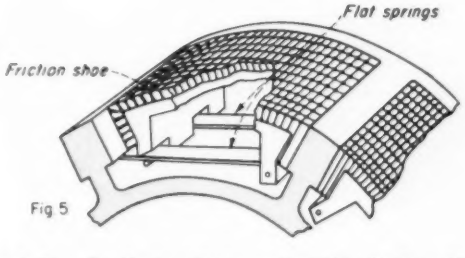
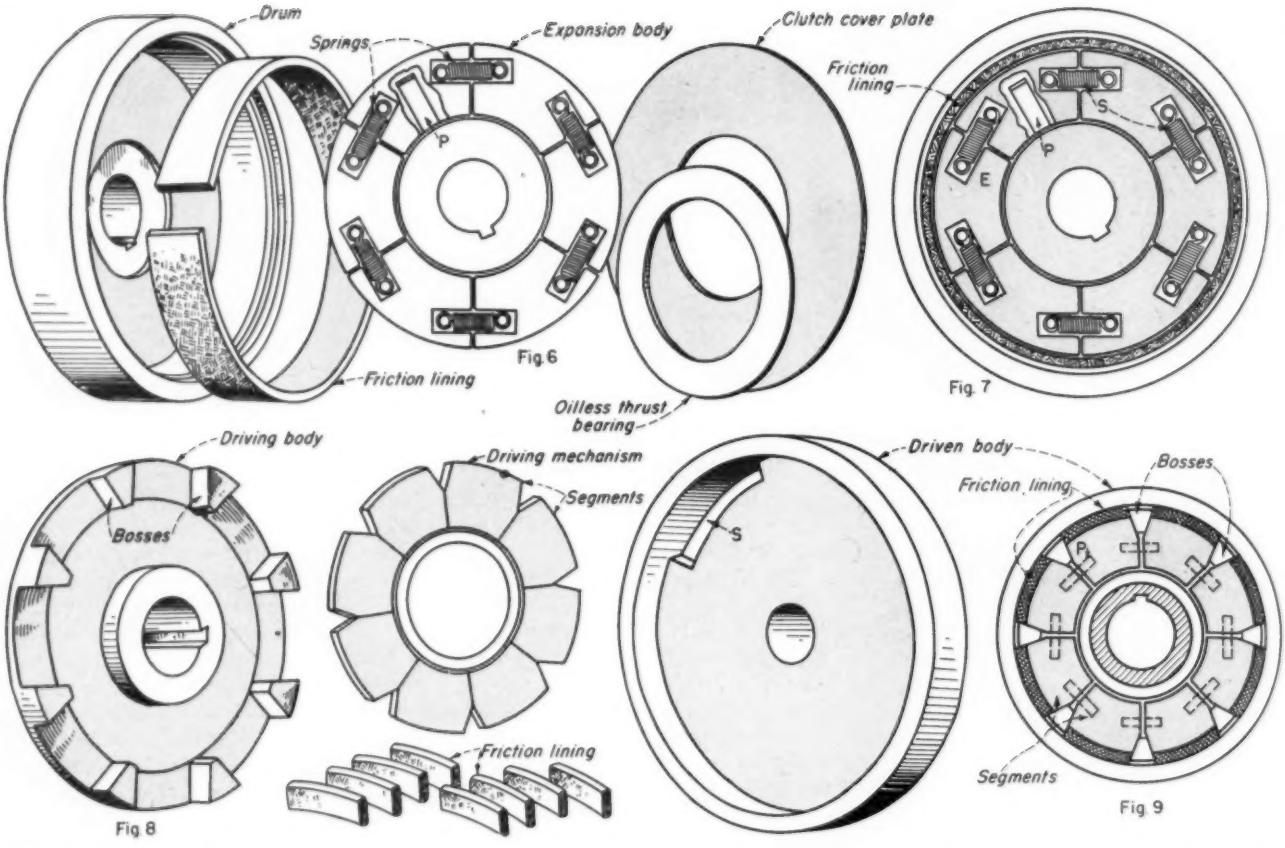


Fig 5

DOUBLE-SHOE DESIGNS: 1 and 2 In this clutch, steel shot about 0.02 in. in diameter forms the power-transmitting medium between driving and driven members. 3 Slipring-starter automatic clutch has friction bands connected at one end to the driving hub. 4 Parts of an automatic clutch using friction members in the driving and driven elements. 5 Design of friction shoes for clutch, Fig. 4, arranged with holdoff springs to hold them in release position for a predetermined speed



SEGMENTAL EXPANSION BODY: 6 Automatic clutch has three main members: drum, friction lining, expansion body to press this lining against drum. 7 Drum, friction lining, expansion-body assembly of clutch, Fig. 6. 8 Driving mechanism in automatic clutch consists of eight metal segments fitted around a ring. Their outer curved ends are chamfered to form vees in which bosses fit on driving member. 9 Section through the assembled clutch, Fig. 8, shows the relation of its parts

member. Thus, outer shoes are actuated by the driving member, inner shoes by the driven member. The two produce a combined action to accelerate the load smoothly and to give overload protection.

Starting a load with this clutch is done in three operations. First, the motor is allowed to start without load, hence it accelerates quickly. As it picks up speed, the outer friction shoes begin to exert a torque on the driven member. When it begins to pick up speed, its shoes come into action on the inner drum to help accelerate the load.

On certain applications, such as dual drives, the clutch shoes must remain released until after a predetermined speed has been reached. For these conditions the inner shoes of the clutch are omitted and outer shoes are held in the released position by flat springs, Fig. 5. The springs are held in slots cut in the walls separating the shoes, as in the figure. Stiffness of the springs is such that the shoes cannot engage until a minimum speed is reached.

Design Has Three Parts. The automatic clutch, Fig. 6, has three main parts, the housing drum or driven member, expansion body or driving member, and friction lining that floats between the driving and driven members. Fig. 7 shows the assembled clutch without its cover plate. The expansion body *E* has six metal blocks, connected by springs *S* and operating on six posts *P* that extend radially from the hub.

When at rest the clutch is disengaged and its metal blocks are held against the hub by springs. As speed of the driving shaft increases, centrifugal force causes the expansion member to press the friction lining gradually against the driven drum to accelerate the load to running speed.

The clutch, Fig. 8, also has a driving and a driven member and a clutch mechanism similar to the design in Fig. 7. The driving mechanism consists of eight metal segments or blocks that fit around a ring. These segments have their outer curved end chamfered to form vees that fit bosses on the driving body. Short lengths of friction lining go between the outer periphery of the segments and the driven body.

Fig. 9 shows a section through the assembled clutch and the relation of one part to another. Interlocking loose pins *P* connect adjacent driving blocks to insure their uniform expansion and distribution of centrifugal force over the whole wall area of the driven body. Worn linings can be replaced through a slot *S* in the driven body without disassembling the clutch.

Mercury-Actuated Clutch. This is a comparatively new member of the automatic-clutch family. In it, a small quantity of mercury, when acted upon by centrifugal force, applies the friction members to accelerate the load to speed.

Fig. 10 shows an internally expanding mercury-actuated automatic clutch in which the driving member connects to a sleeve keyed to the power unit's shaft. When the clutch is released the drum or driven member is free to rotate on a bearing. The actuating force is generated by a small quantity of mercury sealed in a Neoprene annular container.

In the mercury container are two aluminum rings *A* with a radial space between them. Between mercury container and drum are six friction members *F*. When the clutch is at rest the mercury is in chamber *C*, but when the power unit accelerates, centrifugal force drives the mercury out between the two aluminum rings to form an annulus between their outside periphery and the Neoprene gland. Here the mercury annulus increases in thickness to extend the gland radially until the friction members are forced against the drum to drive the load.

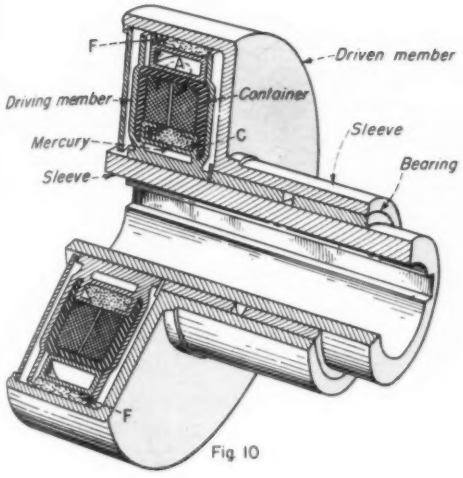


Fig. 10

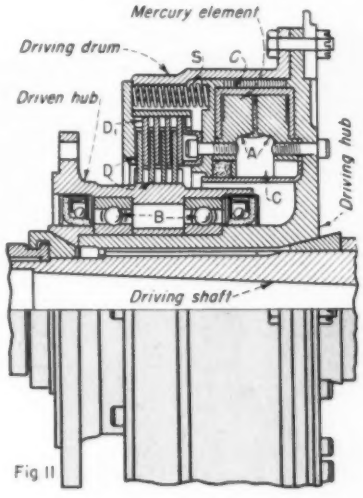


Fig. 11

MERCURY-ACTUATED CLUTCHES: 10 Internal radial-expansion mercury-actuated friction clutch in which driving member connects to sleeve keyed to power unit's shaft. 11 Automatic multiple-disk clutch is actuated by a small quantity of mercury

A second design, Fig. 11, is an automatic multiple-disk clutch applied by mercury, which is actuated by centrifugal force. Two anti-friction bearings *B* support the driven hub on the driving hub, the latter being keyed to the driving shaft. The clutch body connected to the driving hub contains the mercury element, which consists of two aluminum rings *A* sealed with a small quantity of mercury in a rubber container *C*. Alternate friction disks *D* are connected loosely to the driven hub by splines and the other four, D_1, connect in the same manner to the driving drum. When the driving member accelerates, centrifugal force transfers part of the mercury to the space between the two aluminum rings. Here it builds up an axial force until at a given speed it forces the left-hand aluminum ring to the left to apply the clutch to start and accelerate the load to full speed.

Spring *S* is stressed against the mercury pressure so the clutch does not engage until the power unit accelerates above a predetermined speed. Then the load accelerates and comes up to the speed of the driving unit. If this unit slows down below the engagement speed, the clutch releases and the driver may idle at this speed.

A feature of these mercury clutches is the small amount of mercury they require. A 275-hp 2200-rpm clutch requires only about 2 lb. These clutches are built in sizes up to 475 hp for driving a forced-draft fan.

General Characteristics. All automatic clutches described may be used as clutch couplings to connect the power unit directly to its load. They may also be equipped with a gear, sprocket, pulley or V-grooved sheave, for driving the load through gears, chains, flat belts or V-belts.

With an automatic clutch between motor and its load the motor starts without load, even when the clutch does not have springs to keep it released until a predetermined speed is reached. Fig. 12 shows the action of an automatic clutch with and without springs and the speed-torque curve of an 1800-rpm general-purpose squirrel cage motor. At zero speed, using a clutch without springs, the motor is unloaded at standstill. Consequently when the starting switch is closed the motor accelerates rapidly and comes up to speed.

In the early part of the starting period clutch torque is low, being only 20% of full-load motor torque at 33% motor speed, point *A*. At this speed the motor develops over 150% full-load torque, so it continues to accelerate rapidly. Beyond point *A* clutch torque increases rapidly until it equals motor torque at point *B*. Here the motor has attained about 94% of synchronous speed and develops 177% full-load torque.

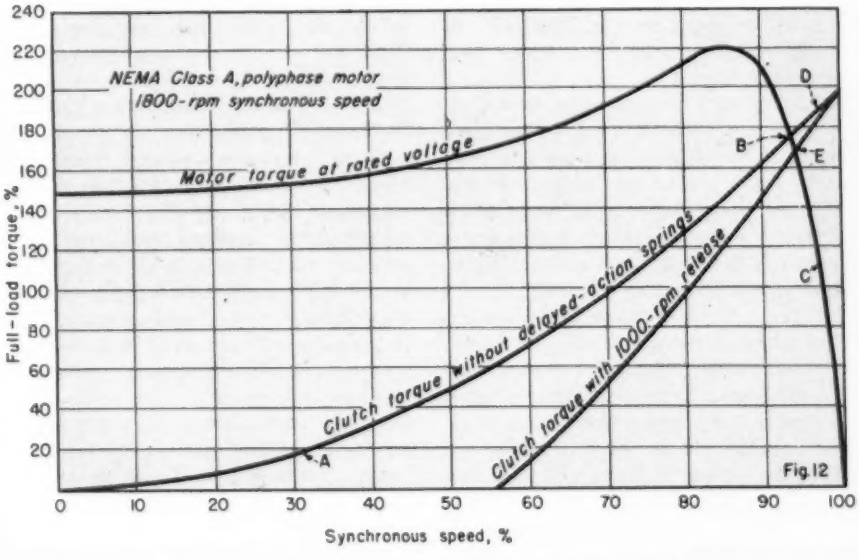
From point *B*, acceleration is down along the motors speed-torque curve to a point corresponding to the driven load, which at 100% load is 97% synchronous speed, point *C*. At this speed clutch torque has increased to 190%, point *D*.

If the motor is heavily overloaded it will slow down along its speed-torque curve to point *B* where clutch torque equals motor torque. At speeds less than this, clutch torque is less than motor torque and the clutch slips to prevent stalling the motor.

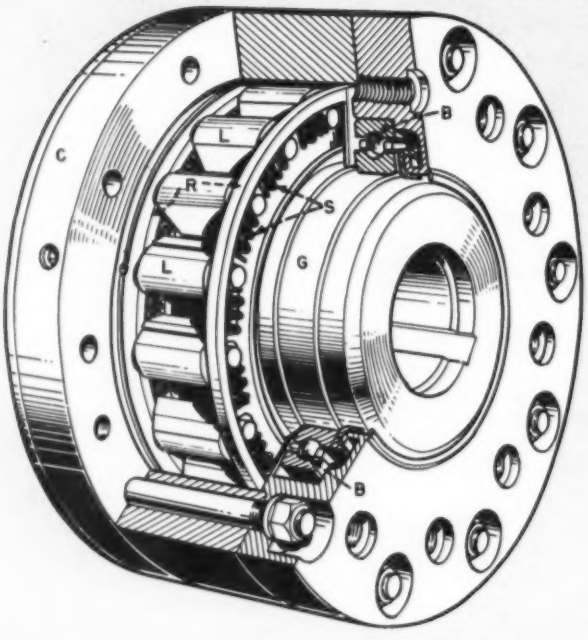
Spring-retarded automatic clutches are available for different speed ranges. In Fig. 12 the clutch does not begin to apply until after the motor reaches 1000 rpm. After the clutch comes into action, its torque builds up rapidly to motor torque at point *E*, only slightly below point *B* for the clutch without springs.

With this clutch between an 1800-rpm internal-combustion engine and its load, at idling speeds below 1000 rpm the clutch releases the engine. Or the engine may be started, warmed up at idling speed, then accelerated to full speed, when it will start to pick up load at 1000 rpm.

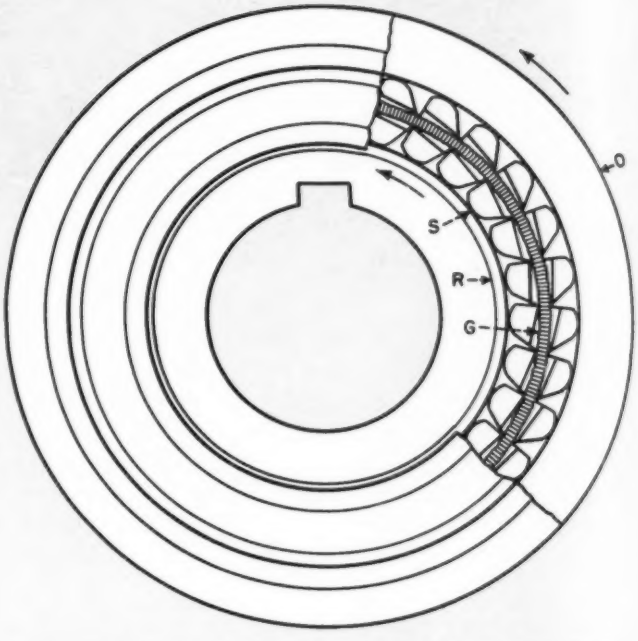
On the curves the wide margin of motor torque over clutch torque shows that with an automatic clutch a simple squirrel-cage motor can handle hard-starting loads with little disturbance to the power systems. This also applies to synchronous motors.



PERFORMANCE CURVES: 12 Performance of an automatic clutch with and without delay springs and speed-torque curve of an 1800-rpm squirrel-cage induction motor



GEARED CAMS: 1 Free-wheeling clutch has outer cylindrical driving member *C* and inner driven member *G* to which cylindrical cams *L* are geared to form the locking or clutching member



BLOCKS OR SPRAGS: 2 Locking member of this free-wheeling clutch comprises assembly of metal blocks or sprags *S*, in annular space between inner race *R* and outer cylindrical race *O*

Free Wheeling

Free-wheeling or overrunning clutches are used on dual, or standby, multi-speed, overrunning, booster and ratchet drives, as back-stops, and on similar applications. With such a clutch between the power unit and the load, as long as the former drives the latter the clutch remains engaged. But it releases if for any reason the driver tends to run slower than the load, or the load's speed is increased above that of the power unit.

Applications. For example, on a dual or standby drive, if each power unit connects to the load with an overrunning clutch, either may start and stop at will without stopping the load. When a driven unit stops it is released automatically from the load without interference with the other driver.

When a 2-speed motor, driving a fan through an ordinary flexible coupling, operates on the high-speed winding and is switched to slow speed, it creates a powerful braking action that may damage the fan rotor. This difficulty can be eliminated by connecting the motor to the fan with a free-wheeling clutch. When switching from high to low speed, the fan is free to rotate until it slows down to the motor speed, when the clutch again connects the two.

The same conditions apply when a slow- and a high-speed motor are used to drive a load. A free-wheeling clutch between the slow-speed motor and its load allows switching at will from one motor to the other without danger to either motor or load. If two free-wheeling clutches are used, one between each motor and its load, either motor may be automatically disconnected from the load by simply opening the power switch. Many other drives exist where this equipment offers economy in power applications.

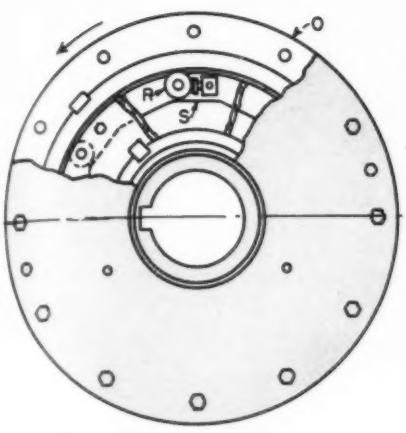
Clutch Has Three Elements. The free-wheeling clutch, Fig. 1, has three major elements: driver, driven, and locking or clutching members. An inner gear member *G* and the outer cylindrical member *C* may be either the driving or the driven member, but it is preferable to have the outer member running during free-wheeling operation. Locking or clutching members are cylindrical cams *L*, with surfaces generated to produce a rolling and wedging action between driving and driven members.

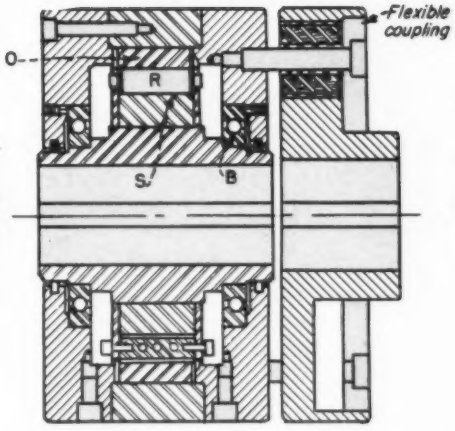
On the inner surface of the cams are teeth that register with gear teeth cut in the outer surface of the inner member. These gear teeth serve to space the cams to keep them in alignment, and to react pressure of the individual springs *S* that rotate the cams and hold them at all times in contact with the outer member.

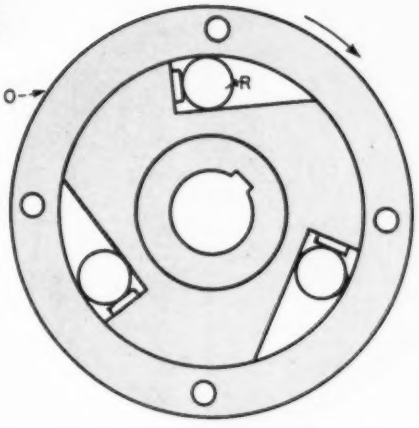
By virtue of two cam-retainer rings *R*, shouldered to support the extension pilot at each end of the cams, centrifugal force of the cams is reacted in a manner that provides for smooth operation of the clutch. The outer-ring member *C* is supported at each end on the inner member by a ball bearing *B*, which allows one member to ride freely on the other during free-wheeling periods.

During free wheeling, cams are always lightly in contact with the outer drum. If the driving member tends to run faster than the driven, friction on the cams rotates them slightly and wedges them between the two members, locking them together. If the driven member tends to run faster than the driving, as when a high-speed motor picks up load from a slow-speed one, or the driving unit slows down, when stopping, for example, the clutch releases the load from the driver.

Metal Blocks or Sprags. In the free-wheeling clutch, Fig. 2, the clutching or locking member comprises an assembly of metal blocks or sprags *S*, in the annular space between an inner race *R* and an outer cylindrical race *O*. Two spiral garter springs *G*, one in each end of the sprags, maintain them in light contact with the inner and outer races. The







ROLLERS ON FLAT SURFACES: 3 Operating principle of this overrunning clutch is that of rollers *R* operating between outer ring *O* and inner one *S*, the latter having flat surfaces

THREE ROLLERS: 4 This free-wheeling clutch has three rollers in half-segment spaces cut in the inner element. Springs hold the rollers in contact with the two elements

sprags have a major axis length greater than the radial distance between the two races.

Assuming the outer member to be the driving one, it rotates in a counterclockwise direction and the sprags lean slightly clockwise as shown to accommodate their major axis between inner and outer members. When the driving unit tends to run faster than the load, the sprags tend to turn counterclockwise and clutch the power and load elements. When the power unit runs slower than the load the outer end of the sprags move slightly clockwise to the release position.

Rollers on Flat Surfaces. Principle of operation of the overrunning clutch, Fig. 3, is that of rollers *R* operating between an outer ring *O* and inner flat surfaces *S*. Rollers *R* are carried in guides so they remain equally spaced and are not affected by centrifugal force. Outer ring *O* is the driving member and the flat surfaces are on the driven part. When ring *O* tends to run counterclockwise faster than the hub, rollers *R* wedge between the ring and flat surfaces and lock the two members together. If the driven member tends to run faster than the outer ring, then rollers *R* release and clutch overruns.

Springs, not shown, hold the rollers in light running contact at all times with the outer ring and flat surfaces, so there is no backlash in the clutch when changing from overrunning to loaded conditions. Even without the spring, rollers *R* cannot drop out of contact very far because stops limit the release movement. Ball bearings *B* support the outer ring on the hub, and the inner parts of the clutch operate in oil.

Three-Roller Clutch. The overrunning clutch, Fig. 4, has only three rollers *R* in half-segment spaces cut in the inner element. The rollers are held in light contact with the two elements by springs. Assume the outer element *O* to be connected to the power unit and rotating in a clockwise direction. When the ring tends to run faster than the hub to which the load connects rollers *R* move forward slightly and lock the two elements together. As long as this condition exists the load is driven by the power unit. If for any reason load speed tends to overrun that of the power unit, a slight forward movement of the hub relative to the outer ring releases the rollers and load.

General Characteristics. All the clutch mechanisms described operate in oil, which lubricates and protects them. Different speed conditions do not affect the clutching action; smooth engagement takes place immediately when the speed of the inner and outer members synchronize.

Overrunning clutches are built in ratings of fractional horsepower to 400 at 100 rpm. Smaller sizes are operated at speeds up to 5000 rpm and larger ones up to 1000 rpm. They are self-contained units that can be used to drive their loads through couplings, chains, gears, belts, ratchet arms, or whatever may be needed for application to a wide variety of drives.

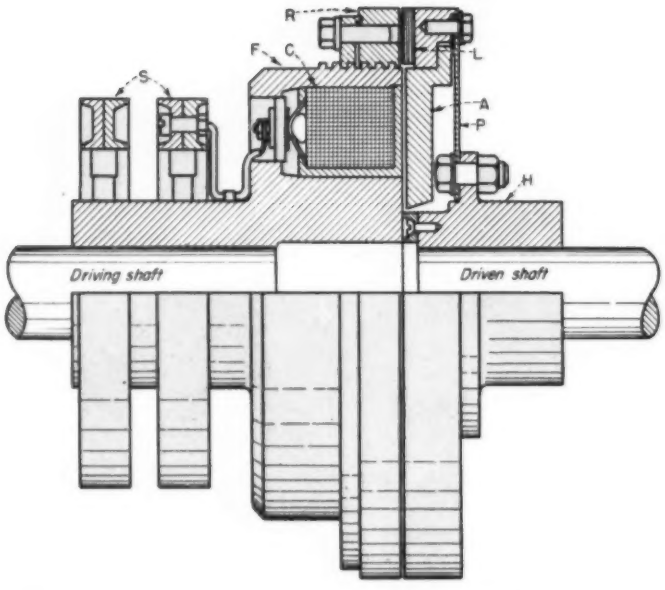
Magnetic Operation

A magnetic clutch is fundamentally a friction clutch, usually applied by energizing a magnet coil and released when the coil's circuit is opened. It is built in single- and multiple-disk designs for a wide range of applications and has the advantage of being closed and released from a remote point by simply closing or opening an electric switch on a dc circuit.

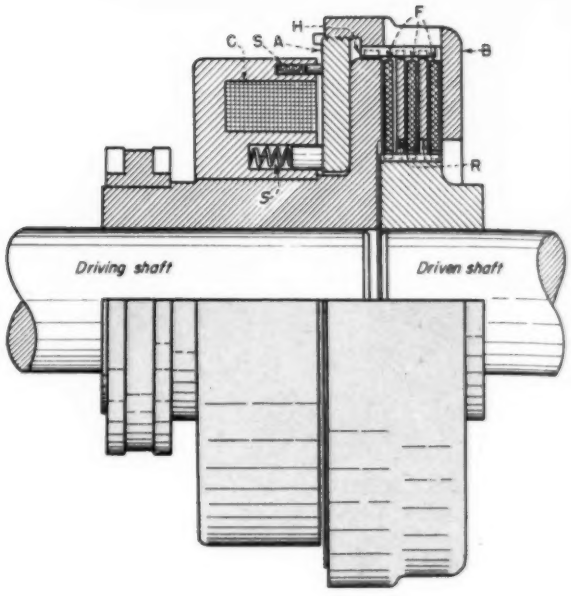
Single-Disk Clutches. The clutch, Fig. 1, consists of a field ring *F* and an armature *A*. The field ring contains magnet coil *C* that, when energized through a pair of sliprings *S*, closes the clutch. L-shaped armature *A* carries the friction lining *L*. Threaded on the outside of the field member is an adjustable friction ring *R* that engages the friction lining. A spring plate *P* bolted to driven hub *H* supports the armature assembly.

This plate maintains a small clearance between the two parts of the clutch when its coil is not energized. This permits the magnetic body to turn freely with the driving shaft, when armature *A* and driven shaft are at rest. When the magnet coil is energized the resulting magnetic pull flexes the spring plate to the friction members. Friction between these parts produces the driving torque that accelerates the load gradually and brings it up to speed. If load exceeds friction, slippage occurs to relieve the overload. Turning friction ring *R* on the field member adjusts for friction-element wear.

Multiple-Disk Units. To increase magnetic-clutch capacity for a given diameter, single-disk units with a double-friction surface and multiple-disk designs are used. Fig. 2 shows a cross section through the latter. In this design, magnet coil *C*, armature *A*, clutch



SINGLE DISK: 1 This single-disk magnet-operated clutch has an armature *A* and friction lining *L* that are supported by a spring plate *P*. When coil *C* is energized it attracts the armature to field ring *F* to engage the friction elements



MULTIPLE DISK: 2 This multiple-disk magnet-operated clutch is used for increased power from a given outside diameter. Springs *S* hold the armature *A* to the right to insure clearance between disks *F* and *R* when the clutch is released

cage *B* and driving rings *R* are carried by the driving hub. Clutch cage *B* and armature *A* are flexibly connected to the driving hub at *H* by splines. Steel driving rings *R* have teeth in their outer periphery that mesh with splines in the clutch cage's inner periphery. These rings clear the driving hub at their inner periphery so that they and the clutch cage are free to rotate with the driving hub when the clutch is released. Friction rings *F* have teeth in their inner periphery that mesh with the driven hub, but clear the clutch cage at their outer periphery.

This construction leaves the clutch cage, driving and friction rings free to move axially. Energizing the magnet coil attracts armature *A* to clamp the driving and friction rings between the clutch cage and hub disk to accelerate and drive the load. When the magnet coil is deenergized armature *A* is released and springs *S* force it with the clutch cage to the right to insure free-running clearance between the driving and friction rings.

There are other designs of magnetic clutches but the two described indicate their general design and the principle on which they operate.

It is well-known that electromagnetic pull increases as the air gap decreases. Therefore, as friction surfaces wear, magnetic pull on them increases as does the torque that the clutch can transmit. In most mechanically applied clutches, wear decreases holding power.

Applications. Magnetic clutches are used for a wide variety of applications, such as the following:

1. As slip couplings, to slip at a predetermined torque, as on tapping machines and dredge pumps.

2. Positive-engagement couplings synchronize the motion of two rotating drives, on steel-mill screwdowns, flying shears, pinch rolls, etc. On some designs for these applications, friction surfaces are serrated to insure positive engagement of the clutch.

3. Accelerating friction clutches accelerate loads driven by low-starting-torque power drives, or allow starting high-inertia loads with a normally rated power drive.

4. Sectional drives accelerate and lock one section of a machine with another, as on paper machines.

5. Automatic sequence control starts or stops a particular motion as part of a cycle on automatic lathes and forming presses.

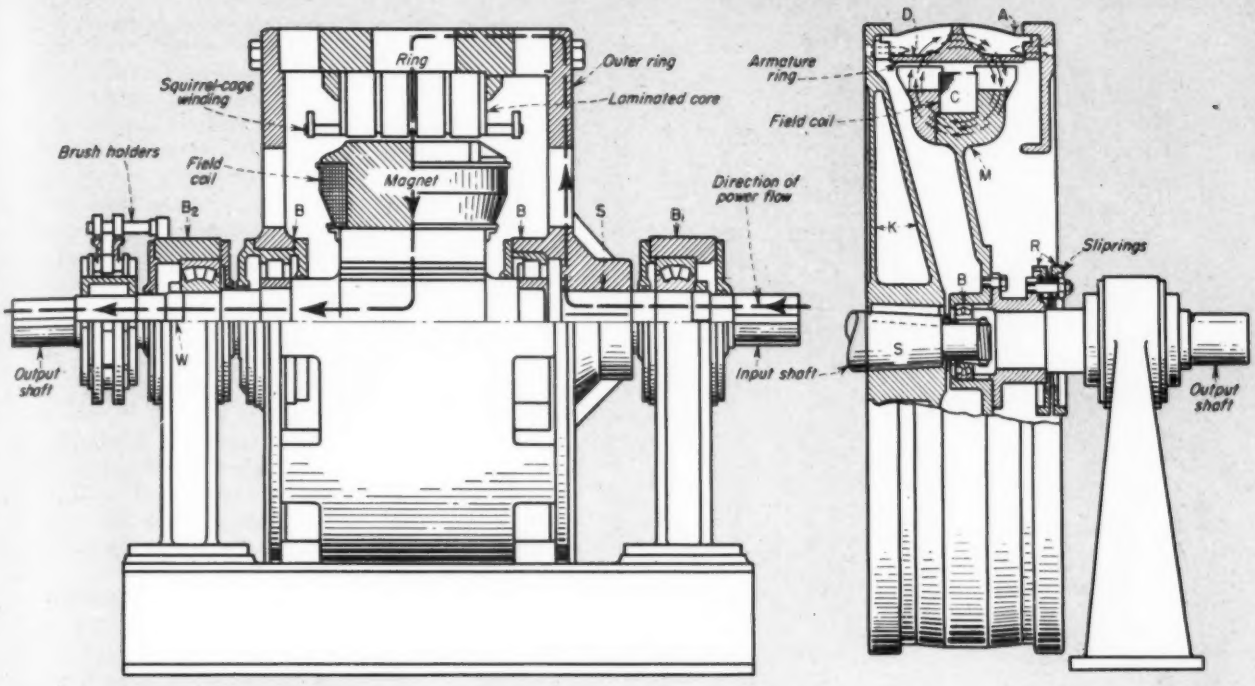
6. Frequent starting and stopping of machines driven by motors that have insufficient starting capacity for the application and where it is desirable to keep down the starting peaks, as on accumulator pumps.

7. A safety device disconnects high-inertia loads for quick stopping when brakes are suddenly applied, as on rubber mills and printing-press drives.

Clutch Ratings. Magnetic clutches are rated according to the torque they can develop with rated voltage across their terminals and a specified air gap, usually between 0.03 to 0.04 in. between the armature and magnet body. This torque is a maximum beyond which the clutch will slip. The torque is expressed in pound-feet, that is, the torque equivalent of the clutch at 1-ft radius. For example, one type of magnet, 20 in. in diameter, with a single friction surface, is rated 1575 lb-ft torque. Magnetic clutches are also given a horsepower rating based on a speed of 100 rpm. The 20-in. clutch just referred to has a rating of 30 hp at that speed and is rated 30x5 = 150 hp at 500 rpm. Standard clutches are designed to operate at peripheral speed up to 7500 ft per min, and with special balancing up to 10,000 ft per min.

Selection. When a magnetic clutch is selected, the size required for a given application depends on the peak horsepower or torque that must be transmitted, shaft speed, frequency of starting and energy, due to slipping when starting or at other times, that must be absorbed. The maximum conditions must also be considered, as well as frequent and long starting periods and allowances made for factors not subject to direct calculation. These conditions are provided for by using service factors. For many applications it is safe to select a clutch having twice full-load motor torque.

To take care of widely varying requirements, clutches of the same diameters are made with different friction-lining areas. For example, a 24-in. clutch may be made with three different friction-lining areas, such as 650, 500 and 330 sq in., and be rated 1270, 2700 and 4200 lb-ft torque, respectively. The clutch with the smallest lining area has the highest torque, and the one with the largest lining area the lowest. The former is used when frequent starting is required at comparatively high speeds, whereas the latter is for infrequent starting and slow speeds.



MAGNET TYPE: 1 When field coils are energized with direct current the squirrel-cage winding generates current that produces torque in proportion to the field magnet excitation

EDDY-CURRENT TYPE: 2 Cross section through an air-cooled eddy-current design of electric coupling that has a special-solid-steel armature ring *D* and the single-coil magnet *M*

Electric Drives

Electric or magnetic couplings, or drives, are sometimes referred to as clutches. They are not true clutches, however, because there is 3 or 4% slip between their driving and driven members. Like friction clutches, they are used to start and accelerate loads after their power units are running at full speed. As there is no mechanical connection between their driving and driven elements they are well suited to prevent transmission of shocks from the load to the power unit, or vice versa.

Magnetic Design. These drives are divided into designs (1) that have a laminated core and squirrel-cage winding in their stator (2) in which an eddy-current ring replaces the laminated core and squirrel-cage winding.

Fig. 1 shows a cross section through one design of electric or magnetic coupling, or drive. It has a field-pole structure like that of a synchronous motor or ac generator, but does not have a damping winding in its pole faces. An outer member has a circular steel-ring back-plate in which is clamped a laminated-steel core, slotted on its inner periphery to form a single squirrel-cage winding. This core and its winding are like the rotor of a squirrel-cage motor except that they form the outer rotating member of an electric drive.

Two bearings *B* support the outer ring so it can rotate freely about the field poles. On the right the ring and field-pole assembly are supported by stubshaft *S* fixed in the ring frame and carried in bearing B_1. On the left the ring is supported by the field-pole shaft in bearing B_2.

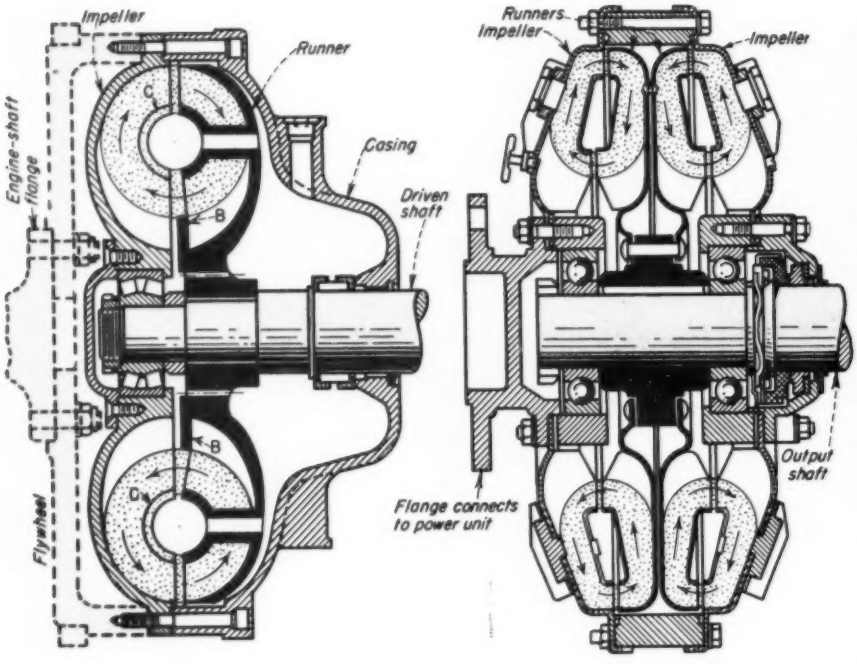
With this bearing arrangement, the drive's field-pole element can be held stationary while the ring with its core and winding rotate about it on bearings *B*, *B* and B_1. For exciting the field-pole coils, dc is supplied through two collector rings from a dc bus, an exciter driven by the power-unit shaft, or from an ac source through a rectifier.

Torque Transmission. The ring shaft couples to the power unit, usually an induction or a synchronous motor. Torque transmitted from driving to driven member depends on the current in the field coils and the slip between ring and magnet. With rated load connected to the output shaft and full excitation in the field coils, full-load torque is transmitted at 3 to 4% slip, but can be made less if desired.

Eddy-current Type. Fig. 2 shows an electric drive that has an eddy-current armature ring *D* and a single-coil magnet *M*. Armature ring *D* is made of a specially treated magnetic steel that produces strong eddy currents, which are always nearly in phase with the magnetic poles. This ring is first made solid, and then closely spaced fins *A* are formed in its outer surface by cutting a series of slots towards the ring's center. These fins carry magnetic flux across the outer part of the ring and serve to radiate heat from it caused by eddy currents generated in the ring. On its left-hand edge armature ring *D* is supported by twin disk *K* on driving shaft *S*.

The drive's inner member consists of ring magnet *M*, with a peripheral slot in its center in which is wound coil *C*; excitation is supplied through brushes on two sliprings *R*. Outer surface of the magnet has slots that look like gear teeth. They are the magnetic polepieces in whose ends high-flux density is obtained to improve the drive's torque characteristics. The dotted rings indicate path of magnetic flux through the magnet and its poles and the fins in the armature ring.

A self-aligning spherical roller bearing *B* on the end of the input shaft supports the magnet and its coil. The driven shaft attached to the magnet may be supported in an outboard pedestal bearing, as shown, or connected to the driven unit's shaft by a piloted coupling.



SINGLE-RUNNER TYPE: 1 When the impeller is driven it discharges fluid through the runner buckets back to the impeller, which causes both to rotate as a unit DOUBLE-RUNNER DESIGN: 2 Axial hydraulic forces in the two working circuits balance out to put the runner in hydraulic balance and eliminate axial thrusts

Hydraulic Drives

Hydraulic couplings are used as automatic clutches in many applications similar to the types described on pp 87-89. These couplings, like electric drives, have from 2 to 4% slip between their input and output members. They possess characteristics, however, that make them better suited to certain applications than most automatic clutches.

They are built for almost any power from ½ hp up, to connect electric motors and combustion engines to their loads in power and industrial plants, in transportation, and in such fields as marine, construction and oil-well drilling.

Hydraulic couplings are also known as fluid couplings, fluid drives, hydraulic clutches and hydraulic drives. They have a primary and a secondary element. The primary element may be considered a centrifugal-pump impeller and the secondary, or output element, a waterwheel.

Traction-Type Couplings. In Fig. 1 the impeller is shown crosshatched and coupled to an internal-combustion-engine crankshaft. The part illustrated in solid lines is the runner or waterwheel, which is keyed to the driven shaft. The coupling is filled with a light mineral oil of steam-turbine quality. When the engine drives the impeller, it discharges oil through the runner buckets back to the impeller, which causes the runner to rotate with the impeller.

Fig. 2 is a cross section of a twin hydraulic coupling of the constant-speed (traction) design. This coupling has two runners connected, back to back, on a hub keyed to the output shaft. A runner faces each impeller. These form part of the coupling casing, which is supported on two ball bearings on the output shaft. Arrows indicate oil circulation between impellers and runners, and show two separate working circuits.

Oil discharged from the impeller to the runner produces an axial thrust that tends to separate the two. In the twin coupling, axial thrust of one working circuit opposes that of the other and they balance out to put the runner in axial hydraulic balance. Blades in impellers and runners are straight so the coupling operates equally well in either direction of rotation, as in Fig. 1. Since the hydraulic circuit is substantially the same in both the impellers and the runners, either may be utilized as the input or the output member.

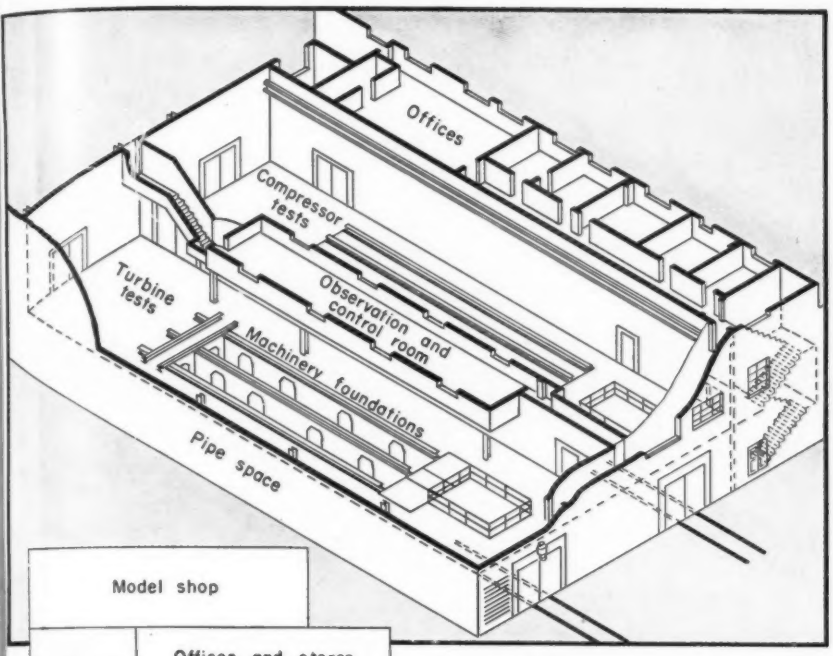
No Mechanical Connection. There is no mechanical connection between the two elements of a fluid coupling, torque being transmitted from impeller to runner by the fluid. Speed ratio between the two depends on the amount of oil in the coupling and the kind of load. With the coupling working circuit full of oil, the output shaft at full load operates at about 3% lower speed than the input shaft. This is known as the full-load slip of the coupling.

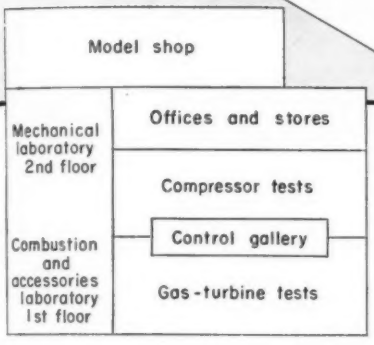
In a constant-speed coupling, Fig. 1 or 2, at standstill the oil is in the casing bottom so that the power unit starts under practically no load. As the power-unit speed increases, oil automatically returns to the working circuit to accelerate the load smoothly. In Fig. 1, baffle *B*, a metal ring, attached to the inner periphery of the runner circuit, reduces the drag torque at starting and limits the stalling torque. The reason is that at slow speed and high slip the oil does not all flow along the outer periphery of the working circuit, so the baffle interferes with its flow and reduces the torque. At full speed, working-circuit fluid takes the position shown, clears the baffle and transmits maximum torque from impeller to runner.

Applications. A fluid coupling between a power unit and its load serves as an automatic clutch. As such it makes possible the use of simple general-purpose squirrel-cage motors for applications that would otherwise require a higher-cost lower-efficiency motor and sometimes a complicated control. The coupling relieves the motor of shock loads, makes shear pins unnecessary and prevents the motor being subjected to stalling loads.

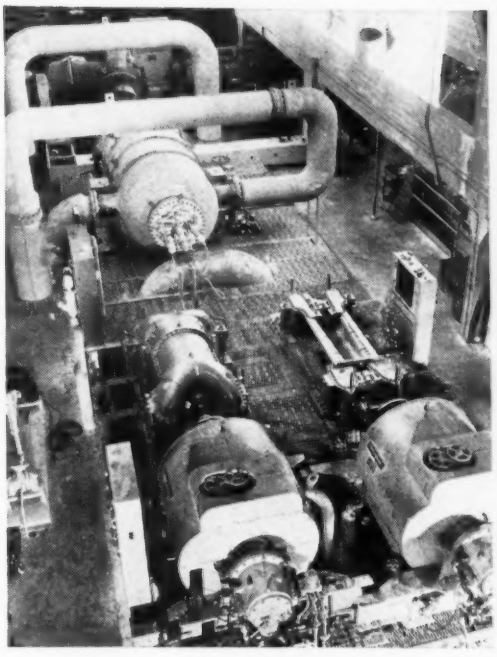
Regardless of the connected-load characteristics, the traction-coupling-equipped motor starts without load, because at zero speed the coupling torque transmitting capacity is zero. The motor therefore accelerates quickly, the coupling delivering increasing torque to the load until the load starts to move. Coupling slip then decreases rapidly until motor full-load torque is delivered to the load at about 3% slip (97% efficiency).

A fluid coupling between a diesel engine and its load performs in a manner similar to a coupling on a general-purpose squirrel-cage induction motor. It permits the engine to start without load, and gradually picks it up as the engine comes up to speed. The engine cannot stall because an overload merely slows it down and increases the slip in the coupling. The output shaft may be stalled under full engine torque, while the engine continues to run at reduced speed until the operator does something to correct the conditions.





LAB LAYOUT is shown in cutaway of high-power test areas (above), and general floor plan (insert left)

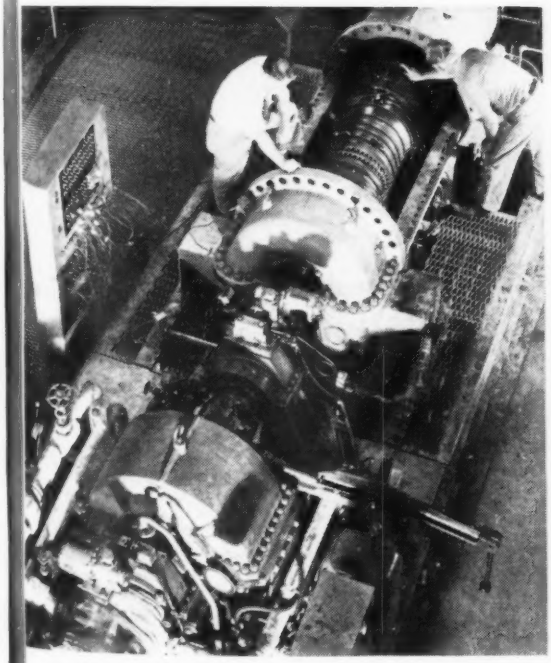


TURBINE UNDER TEST drives water brake (rear right). Axial compressors and a combustor supply needed hot gas

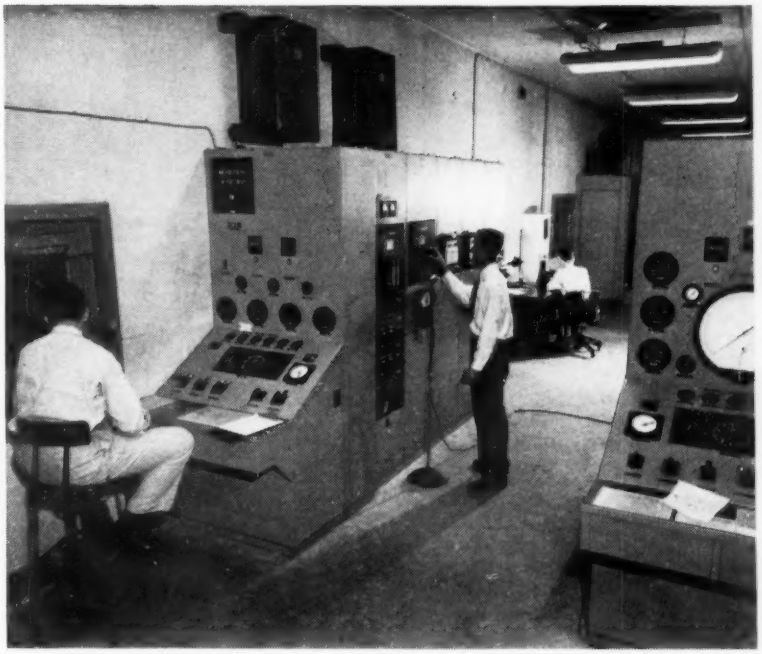
Unusually complete and carefully planned facilities provide for high-power compressor and turbine testing, low-power model work, research on combustion and accessories

Lab Speeds Gas-Turbine Progress

For details and additional photos, turn to p. 98



COMPRESSOR SETUP: Dynamometer drives turbine and test compressor. Bulkhead (left) is terminus for permanent leads to control room



CONTROL ROOM affords quiet, protected area for test engineers, who can see through shatterproof windows and communicate with test areas by public address. All operations may be remotely controlled

More Companies are installing

Because existing Riley steam generating units are performing with such exceptional results, more and more of the country's outstanding industrial and central station plants are swinging to Riley, carrying sales to the highest in Riley history. When you plan to install new steam generating equipment be sure to visit some Riley installations, then you will understand the reasons for this swing to Riley and why users invariably say "you can rely on Riley."

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DISSTON
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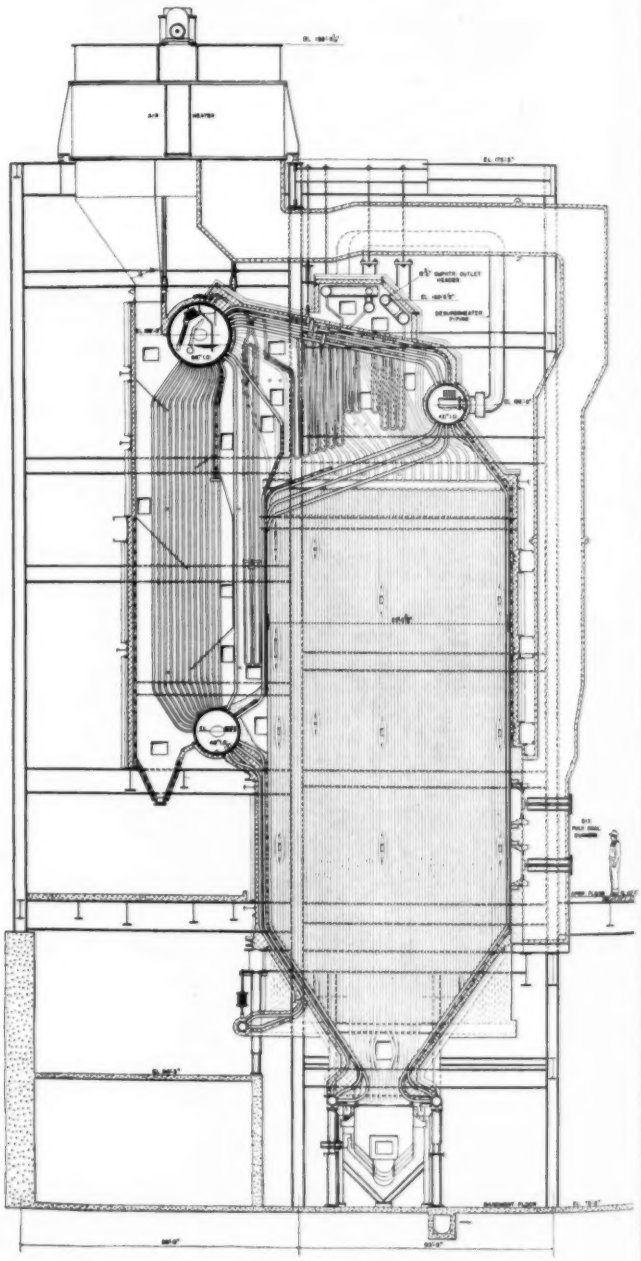
USS AMERICAN MANUFACTURERS WIRE
UNITED STATES STEEL



PUBLIC SERVICE CO. OF IND., Edwardsport, Ind.
Sargent & Lundy, *Engineers*
400,000 lbs./hr. Pulverized Coal Fired

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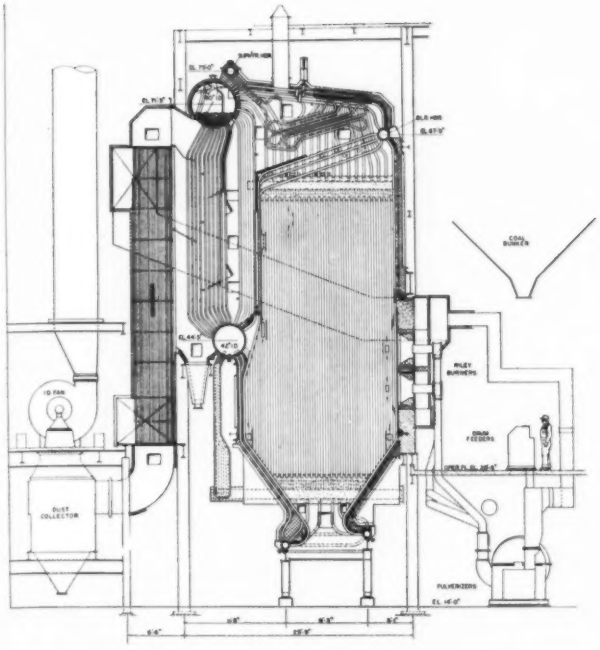
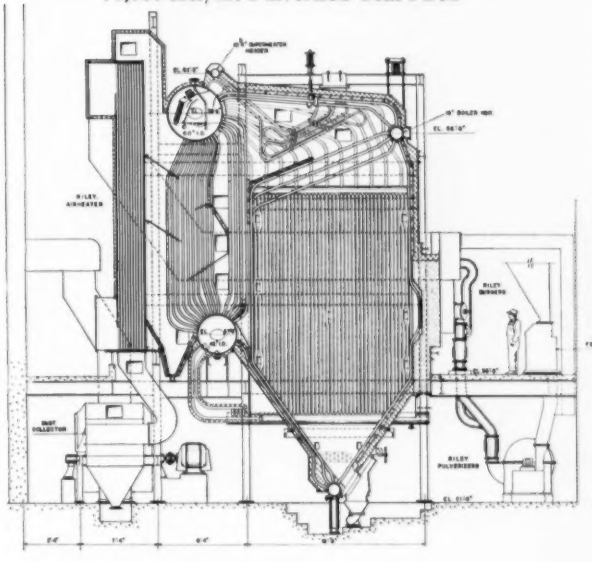
Riley Boilers than ever before



NATIONAL LEAD COMPANY, Sayreville, N. J.
J. G. White Engineering Co., *Engineers*
250,000 lbs./hr. Pulverized Coal Fired

CHAMPION-INTERNATIONAL Co., Lawrence, Mass.
Chas. T. Main, Inc., *Consulting Engineers*
70,000 lbs./hr. Pulverized Coal Fired



While over 60% of Riley Boiler Sales are repeat orders from satisfied users, all of these well-known companies have recently ordered Riley Units for the first time

Public Service Co. of Indiana, Terre Haute, Ind.
Public Service Co. of Indiana, Edwardsport, Ind.
Public Service Co. of Indiana, Noblesville, Ind.
Chase Copper and Brass Co., Waterville, Conn.
Arkansas Power & Light Co., Cecil Lynch Station, Ark.
Congoleum Nairn Co., Cedarhurst, Md.
Ohio Edison Co., Mad River Station, Ohio
Kennecott Copper Co., Hayden, Ariz.
Utah Power & Light Co., Provo, Utah
American Cyanamid Co., Wallingford, Conn.
American Cyanamid Co., Stamford, Conn.
New Orleans Public Service Co., New Orleans, La.
Champion Paper & Fibre Co., Canton, N. C.
Chrysler Air Temp Div., Dayton, Ohio
Pullman Standard Car Mfg. Co., Worcester, Mass.
Southwestern Public Service Co., Borger, Texas
Westclox Division, Chicago, Ill.
Northern Virginia Power Co., Riverton Station, Va.
Cornell University, Ithaca, N. Y.
Cities Service Corp., E. Chicago, Ind.
Alan Wood Steel Corp., Conshohocken, Pa.
Waldorf Paper Products Co., St. Paul, Minn.
Park & Tilford Distillers, Midway, Ky.
Lederle Laboratories, Pearl River, N. Y.
Calumet & Hecla Consolidated Copper Co., Calumet, Mich.
Horlick's Corp., Racine, Wisc.
Industrial Rayon Corp., Cleveland, O.
New Departure Division, Meriden, Conn.
Minute Tapioca, Orange, Mass.
Boeing Aircraft Corp., Seattle, Wash.
Ecusta Paper Co., Pisgah Forest, N. C.
Chillicothe Paper Co., Chillicothe, Ohio
P. H. Glatfelter Co., Spring Grove, Pa.
Gould Paper Co., Lyons Falls, N. Y.

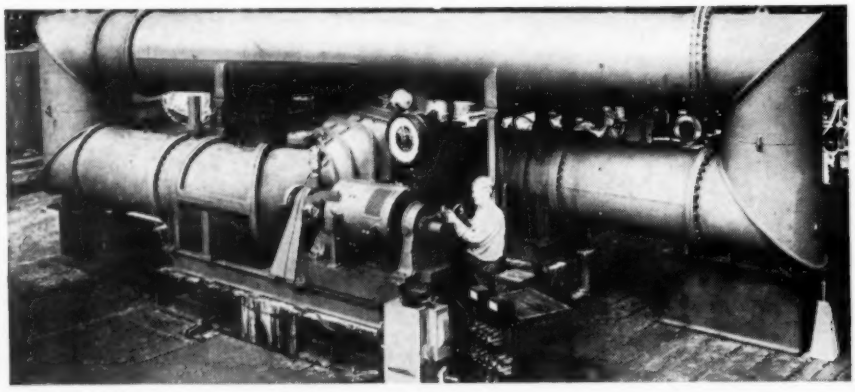
A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings and lower costs

COMPLETE STEAM GENERATING UNITS

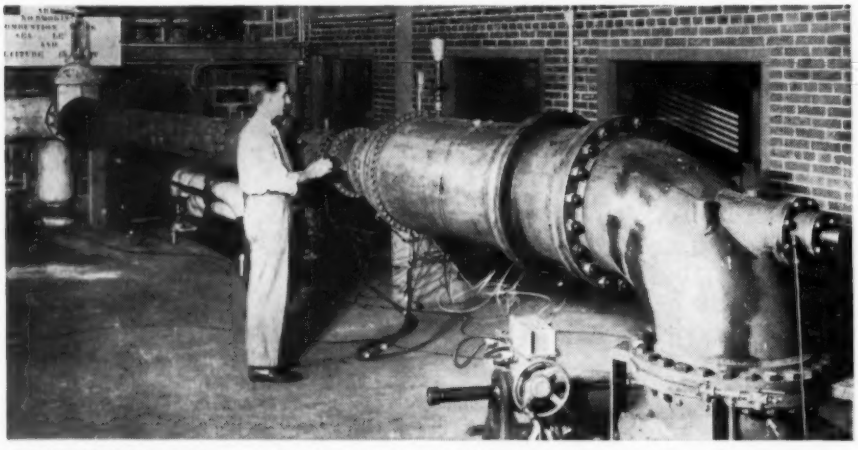
. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

Lab Speeds Gas-Turbine Development (*Continued from page* 95)



MODEL TESTER of highly flexible design permits economical screening of many experimental designs. Symmetrical about the center of the shell-and-finned-tube cooler, it contains all functional elements of high-capacity test facilities



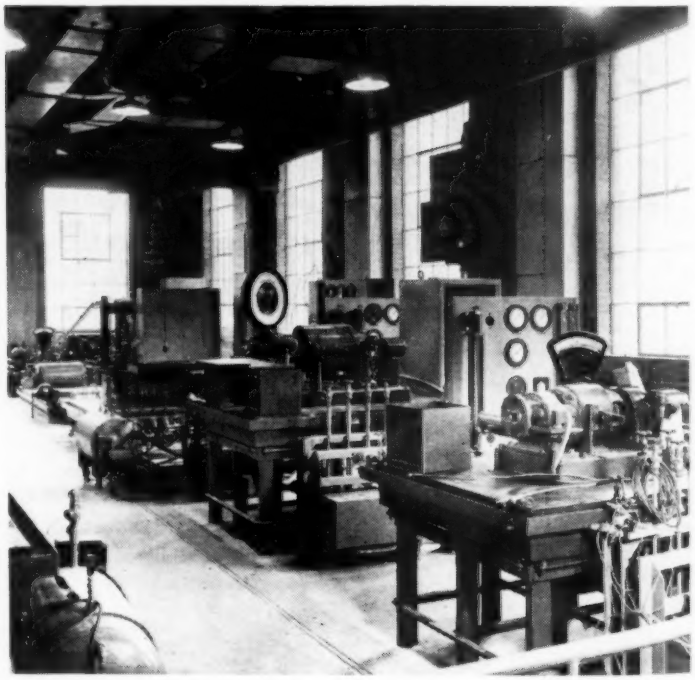
COMBUSTION LAB contains two test stands like one shown. A control room beyond wall at right is equipped for simultaneous operation of stands, with any combination of pressurized, atmospheric or altitude conditions to 45,000 ft

▶ TODAY, LESS THAN four years after a cold start in early 1944, Westinghouse engineers work to capacity a $5-million gas-turbine development laboratory unequalled by any other private facility. This continuous probing into characteristics of aircraft power-plant components yields design know-how needed to meet today's demand for better jet engines and gas turbines.

The job of designing and building a completely American jet engine, taken on at Navy request only one day after Pearl Harbor, was brought to a successful conclusion without recourse to research and development facilities other than those Westinghouse had when war began. But late in 1943 it became apparent that larger facilities were essential to successful realization of the potentials of the gas-turbine power plant. Under Bureau of Aeronautics sponsorship, Westinghouse agreed early in 1944 to design, erect, equip and operate a gas-turbine component lab.

Testing Requirements. A gas-turbine power plant comprises compressor, fuel pump, combustor and turbine, plus lubrication, control and heat-transfer apparatus, and starter, generator and ignition equipment. Separate investigation of the secondary components involves no special testing problems, but the compressor, turbine and combustor require heavy power and heat inputs and dissipations. With this in mind, the laboratory was built to handle full-scale

HOT-SPIN TEST PIT evaluates high-temperature properties of disk and blade alloys. Pit is heavily armored so the tests may be carried to destruction



MECHANICAL LAB aids development of accessories and components. View of one side shows bearing-test stands at rear, governor stand next, and then two electric dynamometer stands

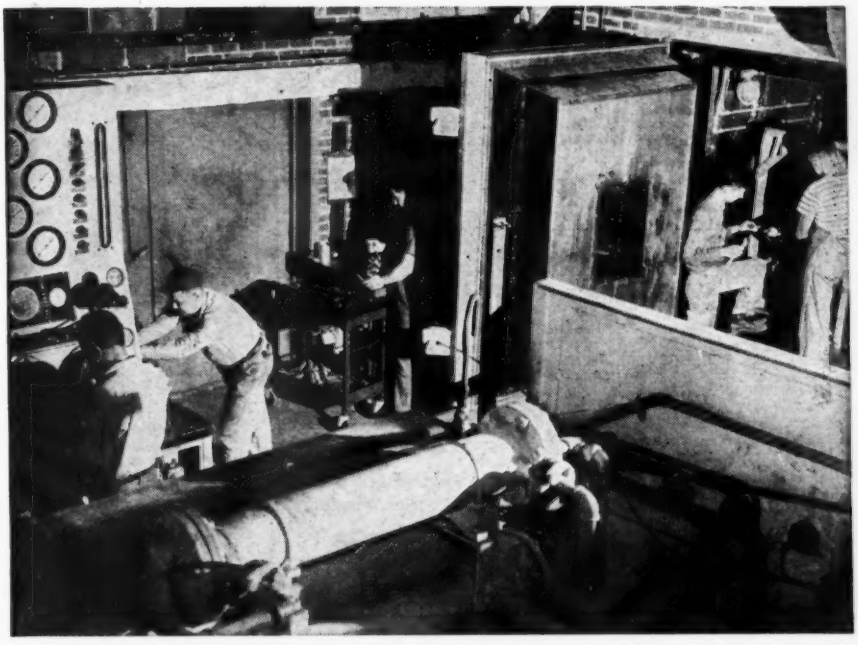
tests for power plants of net output up to 4000 hp. This in no way represents a judgment of engine-size limits. It means the lab can handle units large enough to avoid errors from scale factors without excessive expenditure of materials and manpower.

Availability of steam from a powerhouse, built in 1940 to serve a plant expanded for wartime production of marine propulsion equipment, dictated both lab location and type of equipment drive. As built, the laboratory comprises four major test areas: (1) high-power turbine (2) high-power compressor and low-power model (3) variable-pressure combustion and (4) engine accessory, lubrication and mechanical development. Some idea of the power services required can be gained from these demand figures: 80,000 lb per hr of 600-psi 800-F steam, 7500 gpm of river water, 1000 gpm of well water, 1350 kva of 6600-v ac and 200 kw of 250-v dc.

Lab Layout. High-power test areas (see diagram, p 95) are side by side. For turbine testing, two multistage axial-flow wide-speed-range steam-turbine-driven compressors (one with 4:1 compression ratio, the other with 2:1) can be operated individually or in series with intercooling to supply air up to 118 psia at flows up to 58 lb per sec. A combustor capable of releasing up to 85-million Btu per hr heats air to provide gas to operate experimental turbines at pressures up to 8 atmospheres and temperatures up to 1800 F. Turbine output, which may reach 18,000 hp at 15,000 rpm, is absorbed by a specially designed water brake. The gas-turbine housing, a permanent piece of house machinery, accommodates a series of single- or multiple-stage spindles and blade rings, and can sustain temperatures to 1500 F.

Compressors to be tested are driven by a controlled-torque wide-speed-range cradle-mounted steam turbine, which gives direct measurement of power input. The unit is rated at 6000 hp at 10,000 and 20,000 rpm, but may develop in excess of 7000 hp in the more-efficient intermediate range. The compressor-test housing consists of a heavy section of pipe parted at the center line and two vertical joints, and an end bell with bottom discharge. This provides a universal support for stationary members of experimental compressors. Housing is sufficiently strong to stand compressor inlet pressures from 4 to 90 psi and discharge pressures to 150 psi.

Compressor-test housing is in a closed circuit, which includes a streamlined grid valve, shell-and-finned-tube cooler and an 8-position pneumatically operated variable-area orifice. The closed circuit gives flexibility, by pressure-level control, that would be partly lost with open circuit and intake throttle.



EXPLOSIONPROOF AREA permits use of high-octane gasoline in tests of fuel pumps, governors and injection spray nozzles. Altitude chamber (right) tests accessories under pressure from sea level to 70,000 ft and from —67 to 158 F

In both high-power test areas, planed steel rails define a main floor level about 14 ft above grade, with all steam, oil, fuel and auxiliary piping, and much of the functional air and combustion-products piping, below it. A scavenging system of capacity equal to full required ventilation input confines need for explosionproof units to under-floor areas.

Control operations are segregated from the machinery space in a soundproofed room between turbine and compressor test areas, making for maximum safety and efficiency. Pressure- and temperature-measurement connections are permanently installed from the control room to bulkheads adjacent to the test equipment, reducing length of temporary leads and speeding test setups. Provision is made for complete remote control and communication.

A low-power model tester, comprising a closed circuit with all the functional elements of the high-power facilities, permits economical and flexible evaluation of experimental turbine and compressor designs, screening out developments not worthy of expensive and time-consuming high-power tests. It is symmetrical about the center of the cooler, with a 50-hp dc dynamometer at inboard end of each test section. Each may carry a single or multiple-stage rotor. For testing turbine models, a stock compressor, dynamometer-driven, provides motive fluid.

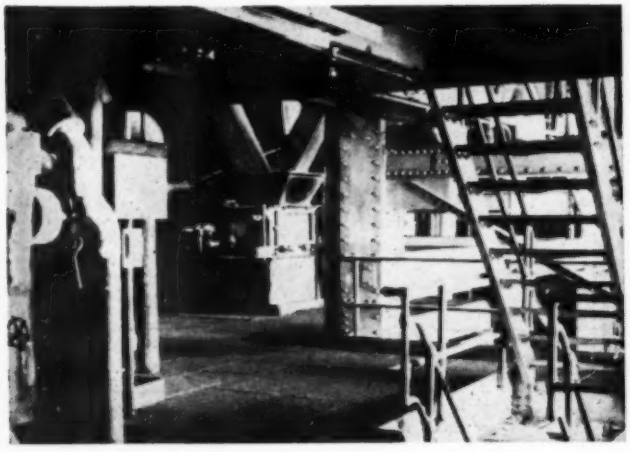
Combustion Lab. In the combustion laboratory, three setups are available: (1) blower-powered atmospheric-pressure tests (2) elevated-pressure tests using compressed air from high-power turbine area, and (3) altitude testing using main compression plant in conjunction with a water-jacketed shell-and-tube cooler.

In the engine accessories, lubrication and mechanical development areas, individual projects on control apparatus, fuel and oil pumps, starters, ignition equipment, bearings, etc, are assembled on bedplates equipped with dynamometers and auxiliary drives ranging from 2.5 to 125 hp.

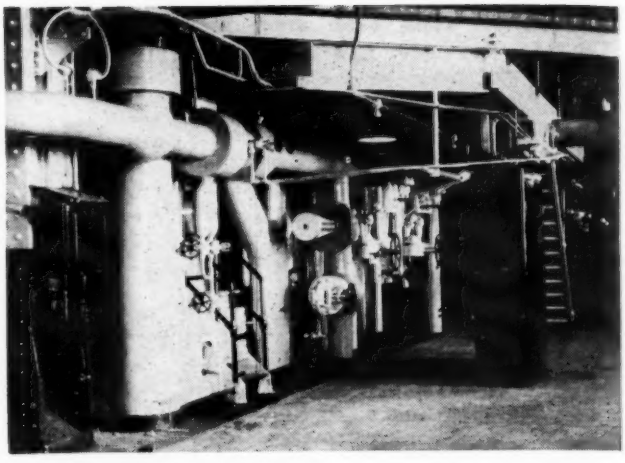
To minimize explosion and fire hazard, three of the accessory bedplates, supplied with gasoline, are installed in a room entirely equipped with explosionproof fittings and services. Opening into the hazardous-accessory test area is an altitude chamber where an entire complement of engine accessories can be operated over a range of atmospheric conditions to 70,000 ft.

An armored hot-spin test pit, a completely equipped model and general service shop, store rooms and offices complete the facilities.

A comprehensive discussion of the laboratory's design features is given in a paper presented by Winston R New at the ASME annual meeting of 1947.



GOOD PLACEMENT KEEPS STAIRWAYS clear of the working areas around a boiler as shown here; boiler corner at left



WATER TENDER'S GAGE BOARD is justified if main board cannot be seen from his station. Board, right center, faces valves

Consider the Operator's Viewpoint When Designing Generating Stations

Because power-plant designers are primarily concerned with the main equipment in a station they often overlook the needs of the men who operate the machinery. Here's a review of many factors to consider while a plant is still on the drawing board

By **J H DRAKE**, *Consulting Engineer*
Reynolds, Smith and Hills

▶ DURING THE PLANNING STAGES, designers sometimes slight seemingly minor items that prove important when initial plant operation starts. They may also greatly affect operating and maintenance ease later. Not all the following conditions apply to every plant; some are purely convenience items. Station size usually controls the decision on some of these factors.

Initial Operation. Let's look first at needs during the starting period when many items are more important than they are later. Amount of automatic-control equipment largely determines the ultimate size of the operating force. This means that the force available is usually too small to operate on hand control safely. Hence, every effort should be made to have all control equipment and indicating and recording instruments ready at the same time as the main units.

Main offices and equipment should be ready several weeks or months before startup. Also essential is an office with a desk for operating personnel. Filing facilities should be available well in advance for construction prints, flow diagrams and instruction pamphlets, which are most valuable during shakedown.

To prevent many delays, smooth-working tool room, storeroom and spare-part systems should be provided early. It is important to have tools, supplies and spare parts at hand during night watches to cope with emergency conditions. Cooperating with these functions, a man on the job during the construction period can often save materials that equal many times his salary.

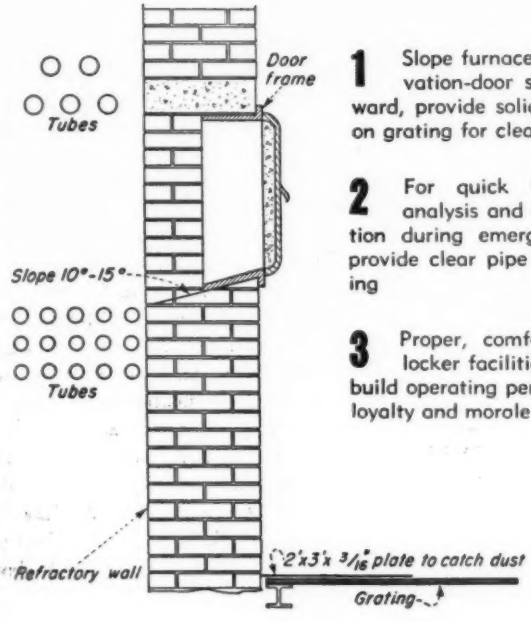
Several minor items, which may be time losers or contribute to potential hazards if not provided, are (1) ladder storage and control (2) key control systems (3) systems for waste, oily-rag and rubbish disposal (4) hose-storage arrangements.

Facilities that prove invaluable in a plant's early days are (1) completely equipped machine shop (2) oil and grease room (3) locker rooms (4) toilet facilities (5) janitors' rooms.

Chemical storage and handling systems as well as a chemical laboratory are more essential during the starting period than at any other time. Instrument-maintenance facilities and the efficiency office should follow closely the initial operation. Portable instruments, which are almost always needed during initial operation, include: orsat analyzer, test gage, dead-weight tester, 300- and 950-F thermometers, 1-in. inclined draft gage, 12-in. draft gage, tachometer, potentiometer and thermocouples.

Accidents and fires are especially liable to occur during the first days. This requires that first-aid arrangements and fire-protection systems be completed in advance. Fires caused by uncovered steam piping and heating salamanders are a particular hazard. Falls and injuries are likely to occur oftener because of confusion from handling

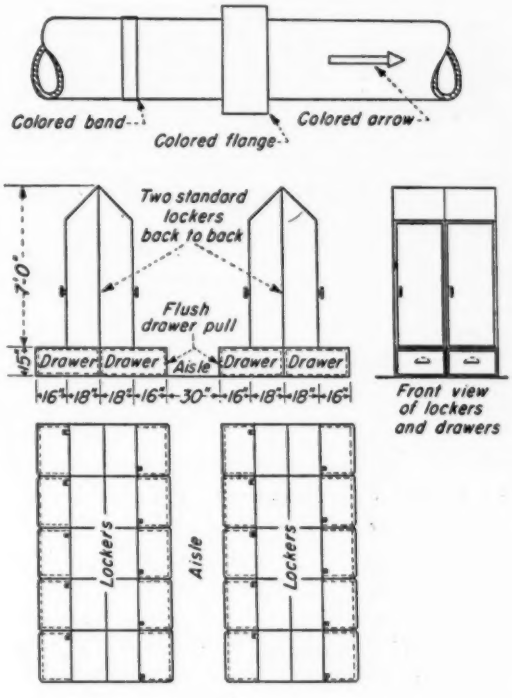
THESE THREE ITEMS NEED ATTENTION



1 Slope furnace observation-door sills inward, provide solid plate on grating for cleanliness

2 For quick trouble analysis and correction during emergencies provide clear pipe marking

3 Proper, comfortable locker facilities help build operating personnel loyalty and morale



unfamiliar equipment. Consideration should be given protection systems for safeguarding operators, construction men and others from hazards of rotating machinery, steam, hot or poisonous gas, water, electricity. Padlocking systems may be desirable at first, but a card protection system with responsible foremen signing on and off is probably a better arrangement.

If operators are allowed to have coffee, soda drinks and between-meal snacks, provision should be made to control these activities and eliminate unsightly makeshift facilities.

System Capacity. For adequacy the firm power (system capacity less than that of the largest unit) should be greater than the system peak demand. As system size increases there will be a point, at about the 6th unit, where two reserve units should be provided. Even before a second reserve unit is needed it may be advisable to supply it as a rolling spare to eliminate storage space for large spare parts. If units are of equal size and of the standard type promoted by manufacturers this may become particularly desirable.

Where system size warrants, a unit of one turbine-generator and one boiler becomes advantageous. This gives one or more power plants under a common roof controlled by the same operators. Operating trouble on one unit does not ordinarily affect the other units, which makes for greater ease of operation and reliability of service.

Auxiliary Equipment. It is important not to overlook providing means for starting up a system in a complete shutdown. Recent developments, for supplying reliable sources of current to electrically driven auxiliaries, indicate that steam-driven equipment is seldom necessary except for small or isolated plants. Transformers, instead of house alternators, are being accepted more and more.

Heat-saving apparatus should be carefully evaluated, especially for small sizes. Proper weight should be given to convenience, space use, maintenance, operator's time and eye apeal before a decision is made to put in an item on a heat and cost-saving basis alone.

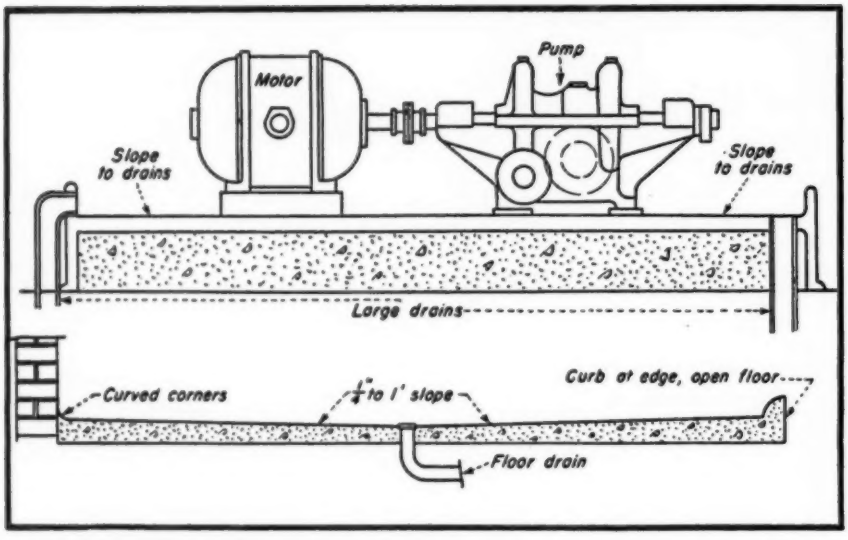
Steam-Generator Control. Placing the water tender's control valves at a point where he can see the boiler-board instruments assures safe and reliable operation during emergencies. If this cannot be done an auxiliary gage board for the water tender is usually justified. An ideal layout groups auxiliary feed valve, automatic feed valve, one mud-drum blowdown valve and the superheater outlet-drain valves at a point where all instruments can be seen.

After a few years' operation superheaters in many plants resemble spaghetti. This is often caused by the operator's failure or inability to open outlet drain valves in time when flow from the nonreturn valve approaches zero. Whenever possible, these valves should be brought to a point near the water tender's station or the boiler board.

Boiler-control board centralization is still debated. There are not yet satisfactory substitutes for constant direct furnace and water-level supervision. Centralization tends to make a congregating area for operators who should be giving attention to furnace and boiler drum. It is high in first cost and maintenance needs and seldom cuts down the number of operators needed.

Piping Systems. Loop systems are often preferable to straight-line-and-takeoff systems for piping of all sorts. Loops permit isolating any piece of equipment and provide alternative feed during trouble. They cut down number of equipment outages, and permit easier maintenance. From the operator's viewpoint they are worth the extra cost and pay for themselves many times. Where the law permits, a single boiler-feed loop system can often be substituted profitably for a main and auxiliary feed system.

Boiler blowdown and drain valves often discharge into a common header. This creates a difficult situation when there are men working in drums of



FLOOR DESIGN FOR WASHING BY HOSE helps rapid cleaning; it must provide adequate slopes for drainage, and eliminate low spots. Pump base conditions need proper drainage facilities too, greater slopes, larger drains than usually provided

boilers down for repairs. Blowdown valves on a dead boiler must often be open with the men working inside. The operator must then choose between the risk of throwing water into a steam turbine and burning repair men during high boiler-water level. This condition often arises in early operation. Hence blowdown and drain lines should be entirely isolated from each other.

Soot-blower systems tied to a common header also present a hazard to men working in dead boilers. Fortunately most designers provide for soot-blowing steam to be taken off the individual boiler. Water column, sampling line and other blowdowns should be similarly isolated.

We do not agree with the opinion that operators should know their plants so well as to make pipe marking unnecessary. A good system of colors or pipe labeling, together with directional arrows, contributes to fast analysis of trouble and quicker correction.

Too much emphasis is placed on providing emergency water from tanks, wells, city water and the like. Probability of losing load from lack of water is remote if the condensate storage tank is big enough, we believe multiple auxiliary sources are not often necessary. Loss of water does not necessarily result in damage to the boiler.

Properly welded pipe joints have proved a boon to plant operators. Increased reliability and decreased maintenance from this type joint are well worth while.

Boiler Access. Stairways, usually placed between and on each side of boilers, invariably interfere with hand lancing, soot blowers, and maintenance work in and around a boiler. If they must be placed between boilers they should be built with multiple landings and short flights, and located away from the area that contains tubes and drums. They should also be kept away from soot blowers, drums and lancing doors. Gratings should be as wide as possible, preferably the full width between boilers or between boiler and outside walls. Where 20-foot hand lances are being used, 15 feet should be the minimum width. Runways should be arranged at each grating level between boilers and between batteries of boilers. Grating, permitting access to water columns on three sides, is essential.

Miscellaneous Items. Floors should be designed for washing by hosing. Floor specifications should be stricter to eliminate low spots. Adequate slopes, curbs and drain points help to keep a floor dry and clean. Special attention should be given drainage facilities around pump bases; greater slopes and larger drain holes are needed than those usually specified.

Alarms and alarm boards should be restricted to vital functions in the plant. They should be arranged so as not to encourage waiting for alarm signals rather than making regular inspection rounds. A considerable number of blank spaces should be left on the board to accommodate afterthoughts.

Good shower, toilet and locker-room facilities build morale. A satisfactory layout saves space by eliminating the need for center benches. This arrangement has the lockers mounted on a base which provides seating room in front of each locker, see sketch p 101. The drawer in the base can hold tools, clothes and other items that are soiled.

Aiming at minimizing and simplifying control systems, careful thought should be given to the number of automatic-control instruments as compared with their cost of installation, operation and maintenance. Too often it is assumed automatic controls are in themselves desirable when such is not necessarily the case.

At times installation of soot blowers is debatable. Occasionally hand-lancing labor is less expensive when balanced against the first cost and maintenance of a soot-blower system. Steam lancing is expensive and dangerous; it is more satisfactory to lance boiler tubes with water and superheater tubes with air.

Refractory sections at bottoms of boiler doors should slope inward to eliminate dust accumulation in door openings. A sheet of solid plate over the grating under each access door prevents dust and dirt dropping to levels underneath.

We believe sound gives sufficient indication of dry steam; an operator's insistance that he should see the steam is archaic. Solidly piped drains eliminate expense and unsightly funnels. Auxiliary ¼-in. open blows may sometimes be desirable in large steam drain lines. Pressure-gage connections on bypasses of large steam valves are helpful when bringing up steam pressure.

Pressure-reducing valves should be avoided whenever this becomes possible. Orifices or flow-control valves are often a better solution.

Insulate any lines that are intermittently hot, drains, sampling lines, etc, from floor to a point 6 ft above at all levels where men might occasionally grasp them inadvertently.

SHARING RESPONSIBILITY

Ideally there should be a close association between designer and plant-operating engineer during the whole design period. This is not always possible as they are often in different cities. But requiring the operator's signature on all design drawings has the advantages of (1) putting a check on the designer (2) keeping the operator posted and forcing him to keep up with progress in design and share in the ultimate responsibility.

Sharing the responsibility to a degree is justified by the fact that in many instances the operating engineer will live with his power plant for the rest of his days.

1 Abrasive in the lubrication and heat from excess grease packed in the bearing caused these balls to fail. As particles of fine steel are removed from bearing surface, they too become lapping material and the wearing action increases

How to Avoid Costly Shutdowns Through Correct Lubrication

Reduced maintenance costs and increased operating time is the pay-off for correct lubrication practice, says A C Skooglund, engineering division, Standard Oil Co of N. J. He describes some of the conditions that proper attention will eliminate

▶TODAY'S PLANT ENGINEER does not have to be convinced of the necessity for preventive maintenance. He knows from experience, and his front office knows from the cost sheets, that most unscheduled shutdowns and the resulting production losses can be avoided if machinery and equipment are properly checked before operations begin. One of the most important factors of preventive maintenance on power equipment is proper lubrication. The plant engineer is aware of this, and is sold on the need for it—but generally doesn't know whether he is practicing proper lubrication.

There is plenty of evidence that too many men responsible for lubrication either do not know how to lubricate machinery properly or fail to adopt practices recommended by the machinery or lubricant manufacturer.

We are not concerned here with the characteristics that are used as guides to the selection of an oil or a grease. That information can be obtained from product literature. Our purpose is to point out some of the malpractices that injure equipment. Some difficulties can be corrected easily and inexpensively, whereas others require costly and extensive changes. The important point to remember is that proper corrections pay off in reduced maintenance costs and increased operating time.

Ball Bearings. A variety of factors cause ball bearing trouble. Most bearing difficulties, such as defective mounting, and improper operating conditions, can be seen by inspection; so can defects caused by improper lubrication. It is not too difficult to see where lubrication is at fault. Misalignment, overloading, brinelling, etc, can hardly be blamed on oil or grease. Conversely, poor lubrication can and does cause damage by contamination, corrosion and excess heat. Premium quality lubricants will not correct these conditions. Only proper lubrication practice will avoid trouble.

Bearing and lubricant manufacturers have so often pointed out that dirt and abrasive foreign matter are a prime cause of bearing trouble that they are often accused of using this as an alibi for bearing failure. Nevertheless, such contamination is the commonest source of trouble. This is because the rolling action of the balls tends to trap foreign particles where the unit pressures between ball and race are high. This laps the ball surfaces and races. Small depressions with rounded edges and of various sizes appear on the ball surfaces and races. Fig. 2 shows this type of depression which is quite different from that produced by overloads or corrosion.

Abrasive Material. To prevent the introduction of foreign material to bearings it is important that (1) the lubricant be absolutely clean, (2) any foreign particles, present after the machine has been assembled, be removed, (3) bearings be adequately sealed off. Fig. 1 shows what can happen to balls if abrasives are allowed to accumulate and start a lapping action.

2 This race shows the effects of abrasive and lapping material on bearings

Corrosion. Trouble with corrosion usually shows up in the form of a reddish brown coating and small holes spread over the entire exposed surface of the races of a ball bearing. Frequently the etching does not show up on the actual path of the ball because rolling action pushes away the corrosive

material. The oxides formed act as lapping agents that cause wear and produce a dull gray color on the balls and races.

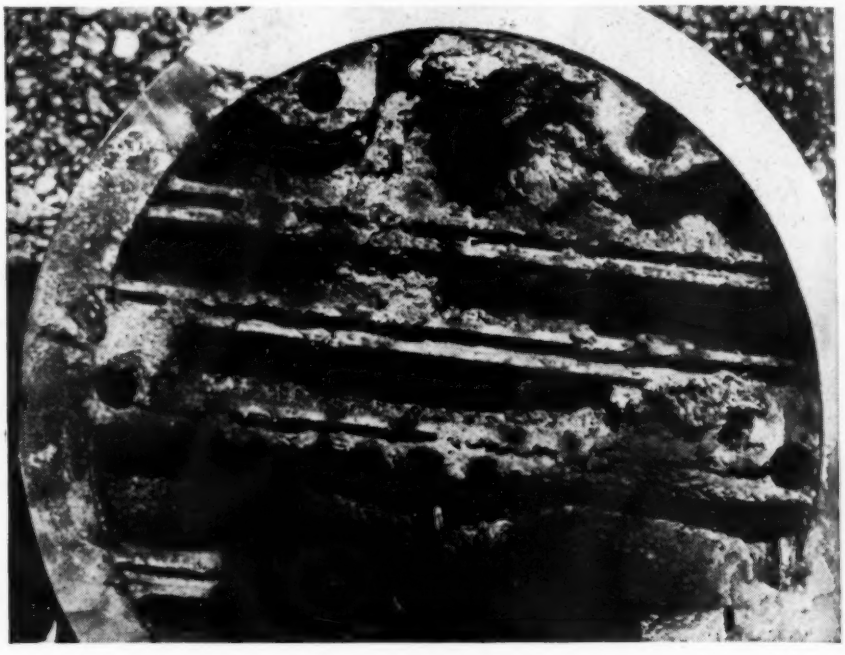
By and large, properly lubricated ball bearings do not suffer corrosion damage. Sealed bearings lubricated with grease may tend to collect moisture, but premium lubricants are manufactured with this condition in mind. Such lubricants actually absorb moisture. Other bearings with poor seals, or none at all, are flushed so constantly with oil or grease that water is not given a chance to collect. It is dangerous, therefore, to apply a water-repellent grease to sealed or prelubricated bearings because water is neither absorbed nor washed away, and has a chance to collect and cause trouble.

Corrosion also results when oil decomposes. Nearly all greases contain a mineral-oil base stock. All mineral oils contain a small percentage of organic acids. In the presence of moisture, and particularly at high temperatures, these organic acids catalyze the oxidation of hydrocarbons in the mineral oil to form more organic acids. Also other decomposition products, such as gum and carbon, are formed. To cope with this condition, most ball-bearing greases contain inhibitors to restrict these reactions.

Too Much Lubrication. Many people believe that the old adage, "Too much is better than not enough" applies to everything. This is a dangerous concept when applied to lubrication. One of the easiest ways to cause an anti-friction bearing to fail is to pack it with too much grease. Often a well-sealed and grease-packed ball bearing operating at high speed runs warm. To reduce the temperature, many operators apply more grease. This is absolutely the wrong thing to do. If the bearing seals are in good condition and a pressure fitting is used, there is no room for excess lubricant. Additional grease can only pack itself tightly inside the bearing cavity around the balls and the spacers. The rolling movement of the balls churns up the close-packed grease and builds up excess pressure.

Some maintenance men cannot break the habit of overlubricating an anti-friction bearing. The best way to deal with these die-hards is to make overlubrication impossible. For example, where pressure fittings are used, a relief port can be set into the opposite side of the bearing so that high pressures cannot be attained.

Compressor Lubricating. It should now be evident that overlubrication can cause damage to grease-packed ball bearings. It is probably less obvious that too much oil applied to a compressor, such as an air compressor, a gas compressor, or even a reciprocating steam engine, can cause a lot of trouble instead of doing good.



3 The burned condition of this cover of an air-compressor waterbox shows the damage that can occur from fire when there is a collection of excess oil in aftercooler

Recently, an industrial plant overhauled an air compressor. The maintenance men thought that with new rings on the piston it would be a good idea to increase the previous oil rate to the air cylinder. They changed the lubricant flow feed from approximately one drop in every 90 rpm to one in every 25. After two or three weeks of operation at this increased oil rate, the aftercooler suddenly burned through.

With the oil feeding at the higher rate, carbon and gum formed and deposited on the discharge valves to such an extent that the valves remained in a partly open position, which caused recompression. As this process continued air became hot enough to ignite some of the carbon deposit. With the high percentage of oxygen present in the high-pressure air, the carbon continued to burn until it had melted down the tubes in the aftercooler and burned a hole in the waterbox cover, Fig. 3.

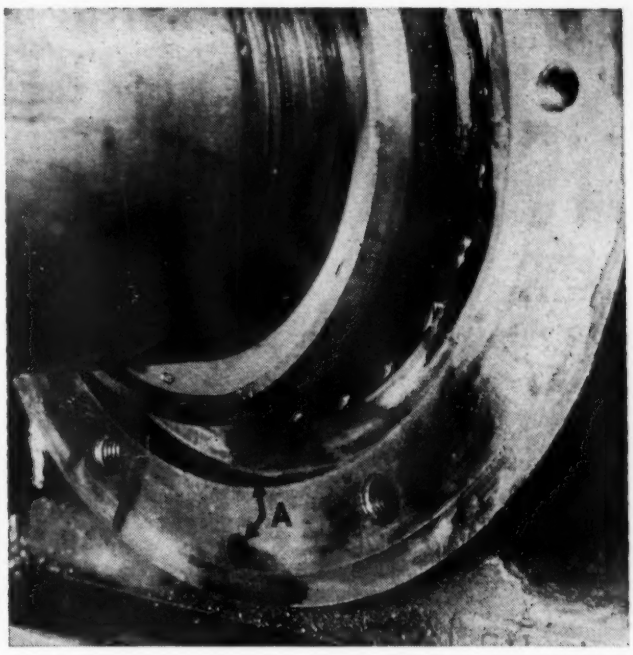
Circulating-Oil Systems. Oil decomposition and dirt contamination can cause considerable damage to equipment served by circulating-oil systems, aside from the main operating bearings.

Dirt and other contaminants, such as gum and carbon decomposition products, readily accumulate in a circulating-oil system. Also, in such systems, a certain amount of moisture condensation will collect and corrode the internal surfaces of oil sumps, pipelines, and housings on the machinery. In time this moisture condensation builds up to such an extent that it causes damage unless it is removed before the oil is delivered to the surfaces to be lubricated. If foreign material of this nature is not removed, it flakes off and is washed away by the lubricant. Carried along by the circulating oil, the pieces lodge in ducts and orifices, restricting passage of oil and preventing it from reaching the bearings. Contaminants can also slow down or actually stop the action of governing mechanisms. In addition, the coating on the oil-cooler tubes cuts down heat transfer, and causes oil temperatures to rise to dangerous levels.

Once deposits are formed, it is difficult to remove them because of the complicated structure of a modern turbine-lubricating system. Here again, preventive maintenance proves its importance. It is cheaper and quicker to keep deposits from forming than to clean up the mess after it has formed and caused a lot of trouble.

Several types of apparatus can be used to remove contamination. One of these is a filter which is made up of a series of parallel fiber wafers through which the oil passes, depositing its foreign particles on the wafer surfaces. These units are relatively simple to op-

4 High temperature caked the oil in this bearing until the oil passage shown at A in the photo was completely plugged



5 After solvent was circulated through the lubricating system the bearing, at the left, was cleaned as shown in the photo

erate and can be used effectively in many types of circulating-oil systems.

Some units use activated clay as the filter medium. A word of caution should be given on activated clay. Laboratory tests indicate that clay has a tendency to remove oxidation and corrosion inhibitors contained in many mineral oils used in circulating systems. If the oil is known not to contain these inhibitors, the claytype filters serve excellently. The clay removes organic oxides and acids to some extent. Inhibitors in an oil keep the formation of these products to a minimum, and clay is not required.

Rust Preventives. Even when using protective equipment contamination can still be a serious hazard in an oil system. Remember that the oil is always cleaned up after it passes from the bearings through the oil sump and is on its way back to do its lubricating job. But after it has left the conditioning unit, there is nothing to keep it from picking up scale, rust and other materials. As mentioned, moisture condensation causes a certain amount of corrosion on the internal surfaces of ducts, pipes and housings through which the oil must pass. All dirt introduced to the oil on the suction side of the filter is removed, but that on the discharge side may accumulate in the oil passages and cause damage. For this reason, it has been found that coating these internal surfaces with a rust preventive pays many times over in reduced maintenance costs.

Rust-preventive treatment is usually administered during a shutdown. All internal surfaces are first cleaned with a solvent, then hand painted with a rust preventive. Pipes and other inaccessible places are treated with a flushing type of rust preventive. A word of caution about bearing housings: the internal surfaces of the housing should be painted, but the bearing seat itself should not be because it requires too close a fit.

Under Lubrication. Everybody knows that too little lubrication causes damage. But we are not concerned here so much with metal surfaces rubbing together as with another factor that is perhaps not so well known to maintenance men. Small quantities of lubricating oil can form coke and gum that are, of course, highly undesirable. This occurs particularly where the machine being lubricated operates at high temperatures. A good example is the drier roll on a paper machine, where the roll is heated by high-pressure steam inside the roll. Here a small quantity of oil is sufficient to lubricate the roller bearing, but it may form deposits because its flow rate is too low to resist the high-operating temperatures. Oil temperature will rise, causing a portion of the oil to decompose. A larger quantity of oil permits a faster flow through the bearing and keeps the lubricant temperature below dangerous levels. Fig. 4 shows a badly caked bearing of this type with oil passage at *A* completely plugged.

If, because of improper maintenance practices, deposits form in a unit to such an extent that trouble occurs, the offending material has to be removed. In such circumstances it is not always necessary to shut down and dismantle the equipment. It is often possible to clean a circulating system by circulating a selected high flash solvent, at relatively high temperature, through the system. Fig. 5 shows the bearing after it was cleaned by this method. It would have required possibly two or three weeks down-time to clean the bearings by other methods. Actually, by circulating a solvent 48 hours, it was possible to clean up the equipment and resume operation in three days' time. This is important on production machinery.

CORRECTION

The data sheet in POWER's Mid-December 1947 issue, page 180, has an erroneous statement of the formula for resistances in parallel. This should read:

$$R = (R_1R_2) \;/\; (R_1+R_2)$$

The nomogram is correct, giving the true answer as calculated by the above equation.

VERTICAL TURBINE PUMPS Q&A

W C Mumford, application engineer, vertical turbine-pump division, Worthington, gives practical information on construction, operation, characteristics, troubles, remedies

2—Application and Selection

Q 1—In what services are vertical turbine pumps used?

A—These pumps fall into two rather broad classifications. Well pumps are installed in drilled or bored wells. The other type is used in tanks, sumps, rivers, reservoirs or similar installations where the pump impellers are submerged or where flow to the pump is under a positive head.

Q 2—What are some of the uses of well pumps?

A—(1) The largest single field is pumping irrigation water. In the state of Texas alone more than 1000 pumps a year are installed for crop irrigation.

(2) Municipal-water supply is probably the next most important field of application. Many municipalities depend entirely on drilled wells and vertical turbine pumps for their water supply. With its enormous reservoir system, New York City has over 300 of these pumps contributing to the total water supply.

(3) In the industrial field, well pumps serve a number of purposes. Many industrial plants obtain all their water from wells, because of inadequate municipal supplies, or, more often, because of the high cost of purchased water.

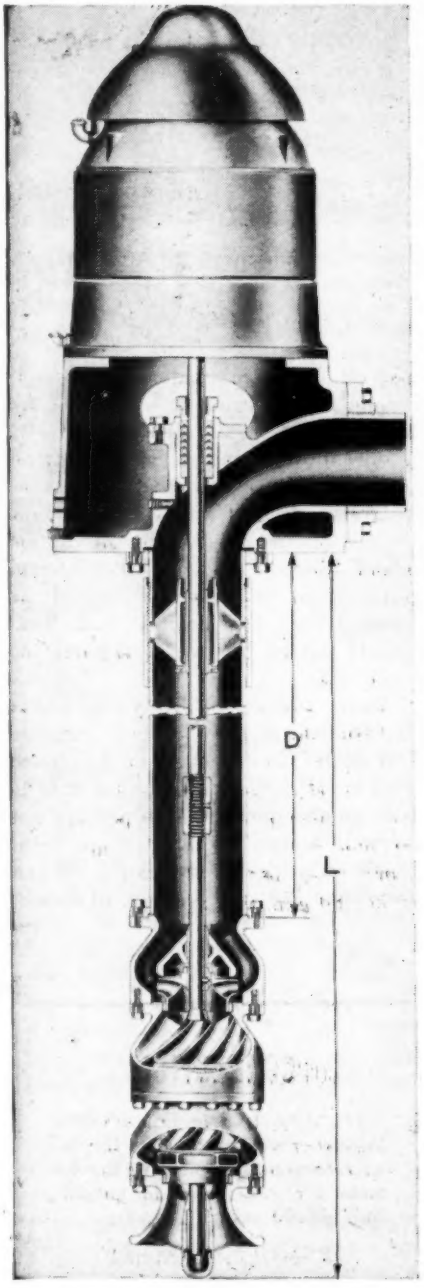
Since most well water remains at a cool, year-round temperature, many of these pumps supply water for processing, circulation, refrigeration and air-conditioning services.

Brine pumping, mine dewatering, oilfield repressuring and many other services are performed by vertical turbine pumps installed in wells.

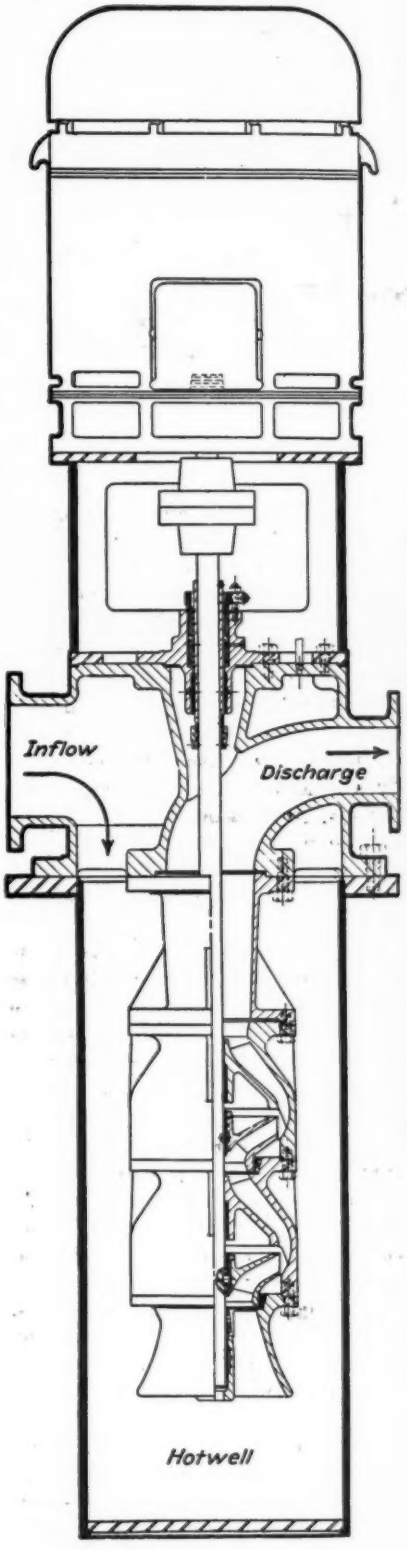
Q 3—When may vertical turbine pumps be considered for applications other than well service?

A—For low suction lifts and pressures this type pump often provides a solution because the impellers are usually submerged in the liquid. For the same reason, priming is no problem.

(*Continued on page* 108)



1 Cross section of a vertical turbine pump used for deepwell installation



2 Vertical - turbine condensate - return pump is for installation in a hotwell

valve values

REG. U. S. PAT. OFF.

Edward Valves, Inc.

SUBSIDIARY OF ROCKWELL MANUFACTURING CO.

EAST CHICAGO, INDIANA

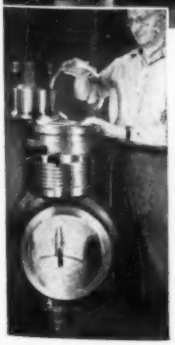
40-YEAR OLD EDWARD *blow-off* VALVES STILL IN SERVICE . . .

After 40 years these Edward blow-off valves are still in regular service and give tight closure. Edward was the original builder of steel blow-off valves.

More than 40 years ago, a railroad car builder on Chicago's far south side erected a new power plant. The blow-off valves, like the feedline and many other valves on the four boilers, were Edward.

The same blow-off valves have been in continuous service ever since and are still tight. There have been no repairs or replacements other than a few new type seats and disks.

Because the valves are subjected to frequent and sudden temperature changes and the erosive action of scale and abrasive material blown through at high velocities, blow-off service is exceptionally severe.



Edward 12 in. angle non-return valves for 1500 lb. 1000 F service. Left valve shows Equalizer running from above disk to outlet.

Internal parts of Edward pressure seal connection.

PRESSURE SEAL BONNET GAINS IN POPULARITY

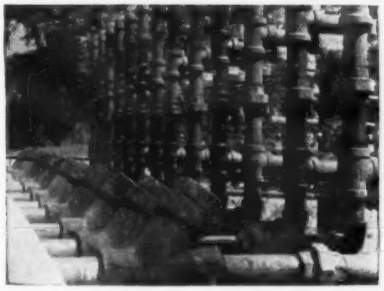
For high-pressure, high temperature service the pressure seal bonnet connection continues to gain in popularity.

At the time Edward began incorporating pressure seal connections as an optional feature on the larger globe and angle stop and non-return valves, body contours were changed and internal flow passages redesigned to greatly reduce pressure drop.

Another feature, in the case of non-return and check valves was the addition of the EDWARD EQUALIZER, a piping arrangement which reduces pressure drop and helps prevent disk fluctuation in service.

Internal parts of the pressure seal bonnet connection are fairly simple but require tool-room machining care to insure a tight joint. A contingent advantage of the pressure seal connection is ease of disassembly after long time high temperature service and greatly simplified reassembly.

ON FLOWING WELLS



At St. Johns, La., are these Edward forged steel check valves, typical of many used in the oil fields.

In this case, Edward 2 in. Fig. 160 valves are on lines from 14 flowing wells at the treater and separator station. Check valves prevent back flow to wells.

Edward builds ball and piston type check valves in horizontal, angle and vertical patterns for pressures to 7500 lb. and temperatures to 1000 F. Sizes ¼ in. to 16 in.

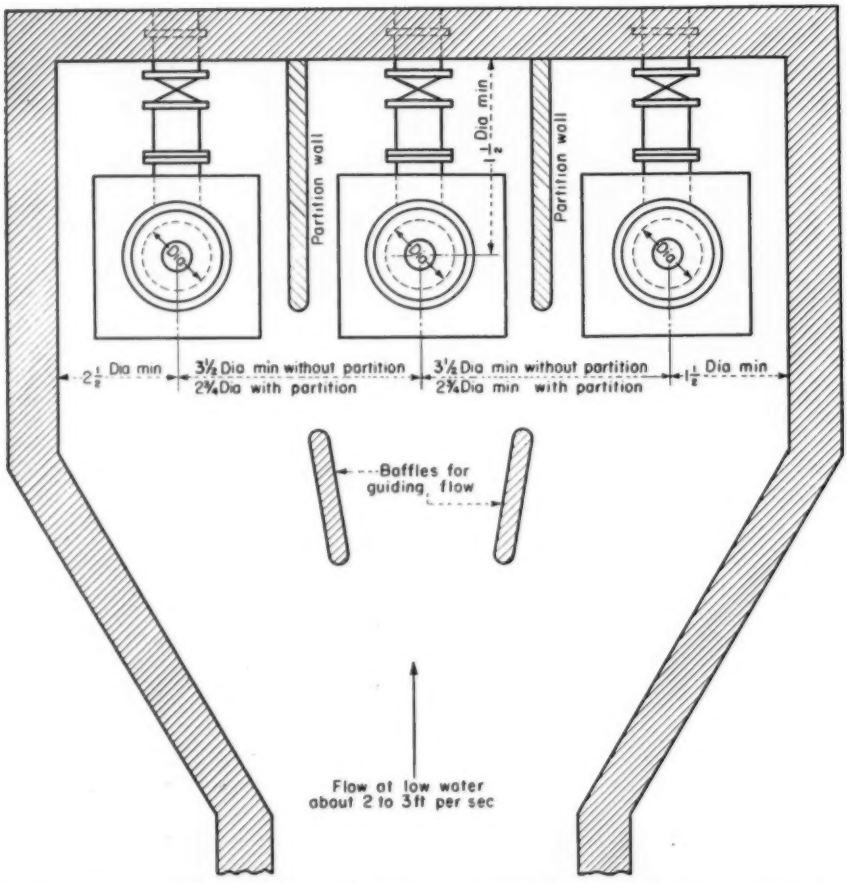
Torque Meter Stops Bolting Guesswork

All torque wrenches in the Edward plant are regularly calibrated on torque meters, before each valve production run, to be sure that wrenches measure correctly. Valve assemblers are thus certain that correct tightening stresses are applied to threaded valve parts.

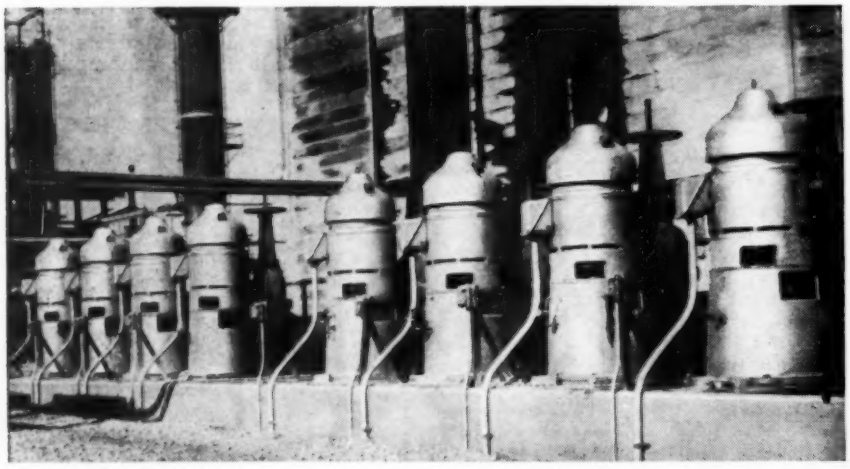
Equal stressing of stud bolts is important in proper assembly of bolted bonnet valves. Properly tightened screwed-in valve seats and bonnet bushings assure leak-proof valve trim. Evenly stressed threaded parts mean tight joints, less effect on bolting from extreme temperatures, and easier remake if a joint is ever broken.

Body-bonnet bolting on large valves is stressed to exact micrometer measurement during assembly.

EDWARD BUILDS cast and forged steel globe and angle stop, gate, non-return, blow-off, feedline stop-check, Intex (integral seat), integral bonnet Univalves, relief, hydraulic, gage valves and strainers for power, petroleum, marine, industrial and technological services.



3 Where several vertical turbine pumps are installed in one sump the spacing of the pumps must be correct. Guides or baffles are desirable to direct the flow



4 Eight single-stage 22-in. 4000-gpm vertical turbine pumps, handling 110-F cooling-tower water under 45-ft total head, are driven by 60-hp 1150-rpm motors

These pumps are easily adapted to limited installation space since pump and driver are assembled on the same vertical axis. For example, a 500-hp motor-driven pump can be installed in a space 4 ft square.

Often the installation of a vertical turbine pump for submerged operation eliminates an expensive dry-pit construction and thus reduces construction costs considerably.

Q 4—How do vertical turbine pumps for well installation differ from those used in wet-pit or pump service?

A—The principal difference is in the discharge-column length *D*, Fig. 1. Well pumps usually have 50 ft or more of column; they have been installed with column lengths of over 800 ft. Wet-pit pumps are usually relatively short and sometimes the bowl assembly may be directly connected to the driving head, Fig. 2.

Q 5—What is meant by pump setting?

A—It is the length of column and shaft assembly, *D*, Fig. 1. Installed in wells, a pump's setting is usually established by the water level when pumping at required capacity. For a pumping level 150 ft below ground the pump would probably have a 150-ft column and shaft, which would be called a 150-ft setting.

The term "setting" should not be confused with the actual over-all length of a pump, *L*, Fig. 1, since over-all length includes the length of the bowl assembly, also suction pipe and strainer if these items are furnished.

For sumps, tanks and pits, pump length must often be short. Over-all length below the pump's base is of more importance than actual column and shaft length in these installations. Therefore, when preparing specifications and describing these equipment omit the word "setting."

Q 6—What are some applications of these pumps when not installed in wells?

A—Typical applications are drainage, construction services, mine sinking and dewatering, process circulating, liquid transfer, cargo unloading, screen washing, cooling-tower water circulation and booster services.

Q 7—Does sump design affect pump operation?

A—Yes, correct wet-pit construction is important to satisfactory pump operation because pit design largely governs water velocities, suction submergence and inlet-flow characteristics. Water entering the sump at high velocities is apt to create turbulence, eddies and whirlpools. Correct sump design limits incoming velocities to about 3 ft per sec.

Where several pumps are installed in one sump, their spacing must be correct, so guides or baffles are desirable. Fig. 3 shows a satisfactory arrangement. But since the liquid, temperature, number of pumps, impeller design and other contributing factors affect each installation, give the pump manufacturer complete sump details for making final recommendations. Improper sump design may cause rough operations, cavitation, reduction in capacity, and reduce pump life.

(*Continued on page* 140)

SMALL TRAP

BIG *Performance*

Little? Sure. But what a giant's job they do!

That's how men judge Yarway Impulse Steam Traps.

Yarways are well suited for trap service throughout industry. The small size itself is an important feature. They are easy to install, fit in anywhere, require no special supports.

In service they *drink* condensate, discharging *continuously* on heavy loads, at short *intervals* on light loads—providing maximum heat in the shortest time, and keeping equipment at top efficiency.

Yarways are suitable for all pressures without change of valve or seat. Simplicity of construction (only one moving part) minimizes maintenance. Also, initial cost is low.

Try some Yarways today—standardize on them tomorrow. See your nearest Supply House or write for Yarway Bulletin T-1739.

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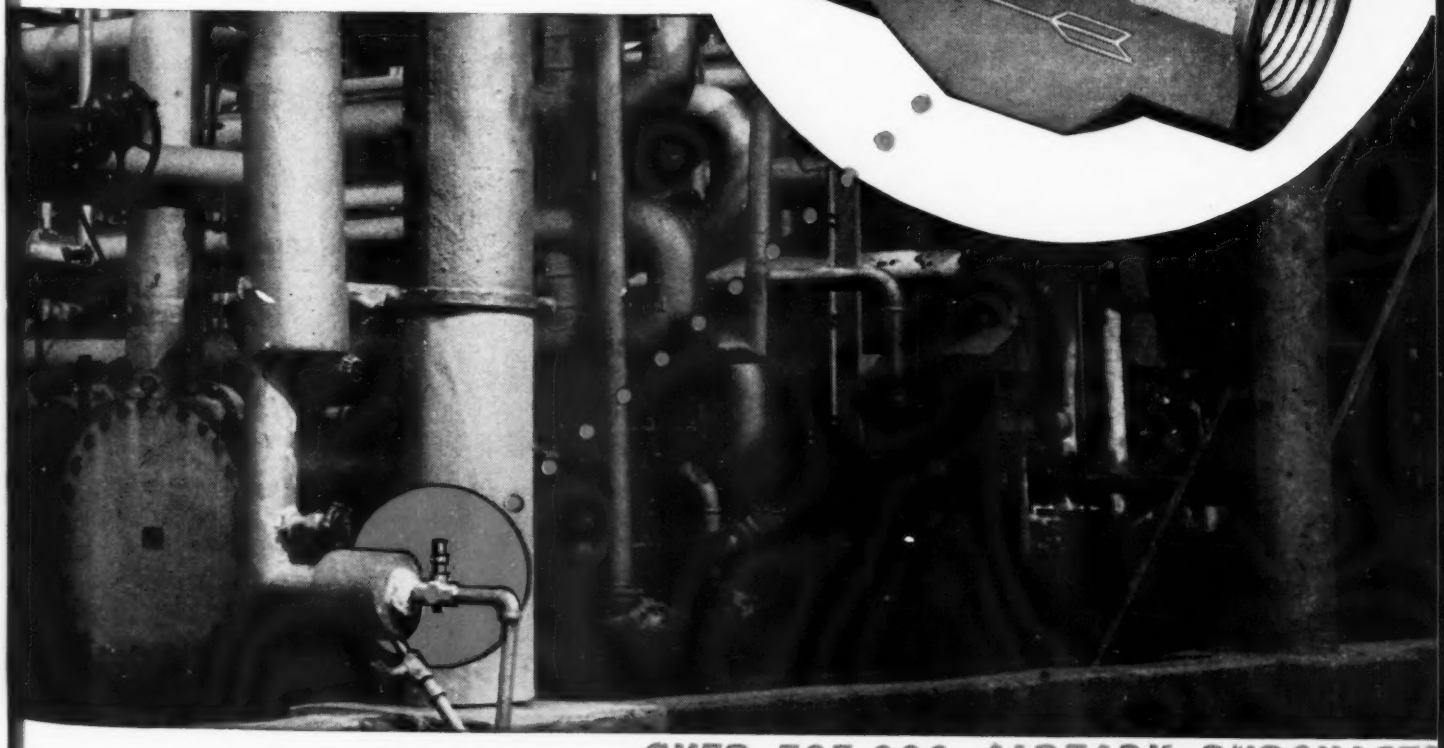

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YARWAY IMPULSE STEAM TRAP

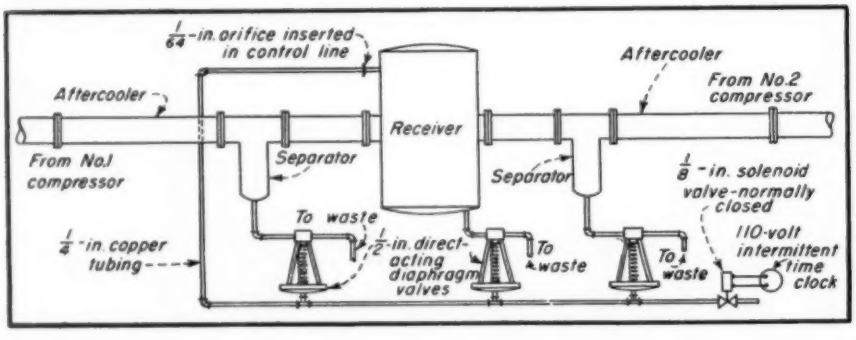
POWER ENGINEERS' NOTEBOOK

PLANT-TESTED IDEAS TO SOLVE PROBLEMS OF DESIGN, OPERATION AND MAINTENANCE

CLOCK-CONTROLLED VALVES DRAIN COMPRESSED-AIR SYSTEM

To INSURE positive periodic drainage of water and oil from a compressed-air system fed by two units the arrangement in the sketch below was used.

Air to operate the diaphragms comes from the receiver tank after passing through a 1/64-in. orifice in the line. At the far end of the line a 1/8-in. direct-acting solenoid valve was provided. This valve operating on 110-v 60-cycle current was controlled by a time clock originally built for household stokers. The clock would run the stoker a short period each hour to keep the fire going when the thermostat wasn't calling for heat. These clocks are available and relatively inexpensive. Here the clock energizes the solenoid for 30 seconds, every hour, opening the valve. This bleeds the control air to atmosphere and drops its pressure, which opens the diaphragm valves for draining. When the solenoid valve closes, control-air pressure builds up, closing the valves.



MARSHALL A JUBIN *Anderson, S. C.*

WATER RHEOSTAT LOADS GENERATORS FOR TESTING

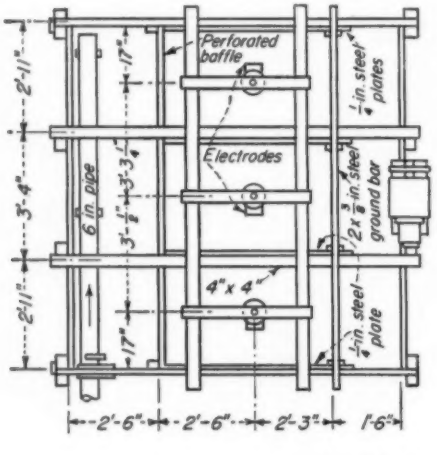
HERE ARE SPECIFICATIONS for a water rheostat that was used to run load tests on seven 2500-kw 11.5-kv 3-phase diesel generators. Water flow enters the stilling basin through the 6-in. pipe, which has ¾-in. holes spaced on 4-in. centers arranged in three rows of 26 each. The rows, which are drilled 45 deg apart, face the rear wall. Pipe clearance from basin bottom is 3 in.

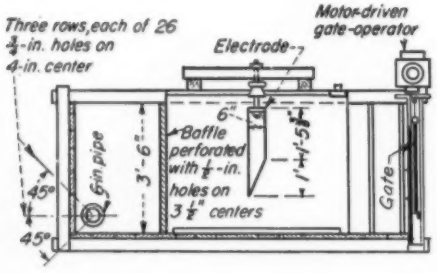
The perforated ¾-in. board baffle, located 30 in. from the rear and extending the full height of the box, forms the stilling basin. From here water flows into the electrode cells through ½-in. holes in the baffle, spaced on 3.5-in. centers over its whole area. From the electrode cells the water flows to waste over top of the discharge gate.

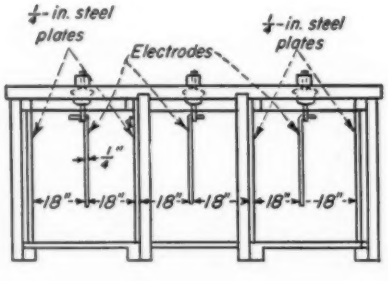
Constant cold-water flow between electrodes and neutral plates dissipates the heat while discharge over the gate top keeps the water surface free of foam. Raising and lowering the gate with the motor drive varies water level to make load adjustments. Limit switches keep gate travel and water level within a range of 20 to 120% full load on the generator.

In operation, steaming and gassing appear at the downstream edges of the electrodes and some slight arcing occurs at the electrode tip and the water surface. To insure keeping loads constant, electrodes have to be replaced after every two weeks of operation. They are connected in Y to provide a neutral ground connection.

Incoming raw-water flow is 400 gpm at 85 F, and has a resistance of 3100 ohms per cu in. When using treated water at 2600-ohms-per-cu-in. resistance it is necessary to lengthen the current path by laying a rubber mat. 3 ft wide, extending continuously over the neutral plates and floor of the electrode cell and centered about the electrodes. Kw flows vary directly with electrode areas, while voltage drops vary directly with the distance between electrode and neutral plate.





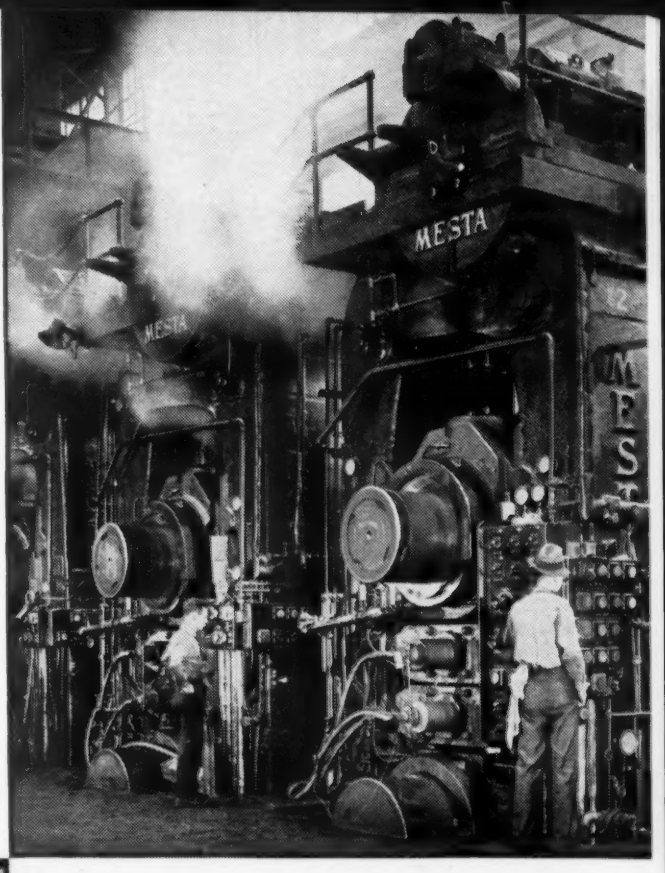


JOHN L KING *New York, N. Y.*

(*Continued on page* 112)

SUNVIS "900" OILS . . for the toughest lubrication jobs

Sunvis "900" oils are in use today in turbines, circulating systems, hydraulic systems, textile machinery and in many other types of application.



Two years ago, we introduced our Sunvis 900 Oils, Sun's premium grade for industrial use. Since then, Sunvis 900 Oils have been proving their ability to resist oxidation and sludging under the most rigorous operating conditions. They stand up for long periods of continued use at extremely high temperatures without appreciable change in physical characteristics, body, color or "neut number." Sunvis 900 Oils possess a high viscosity index and in addition have the unusually low pour-point of 0°F.

Wherever continued operations, high speeds, heavy loads and extremes of temperature combine to threaten your equipment investment . . . wherever lubrication problems are really *tough*—rely on Sunvis 900 Oils. There are distinct grades specially created to meet the requirements of each kind of application. All are fortified against the formation of harmful oxidation products, sludge and rust.

Sunvis 900 Oils assure you of economies through longer equipment life, continuous operations for longer periods between oil changes, less frequent "down time" for inspection and repairs.

For details write to the Industrial Advertising Department for Sunvis 900 booklet.

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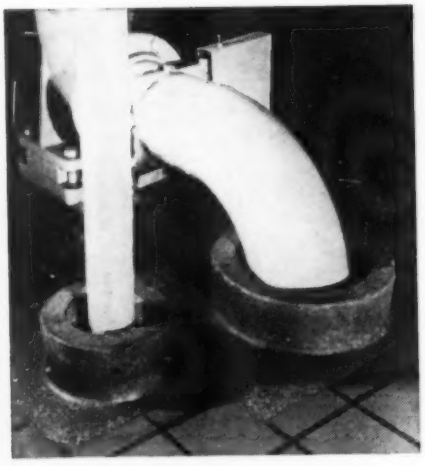


Piping Collars Have Several Advantages

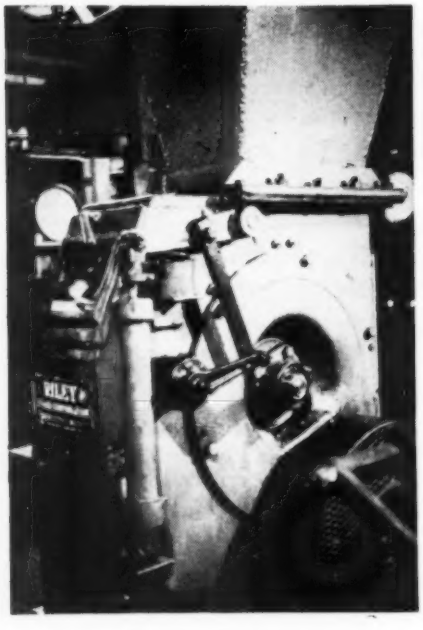
WHERE PIPING goes through a floor, good planning provides a raised collar around the hole as shown in the adjacent photo. A little ingenuity makes these collars attractive as well as functional. They permit sweeping and floor washing without danger of dirt and water falling to a lower level. During maintenance operations they are safety devices, preventing tools, parts and nuts falling to the floor below and causing possible damage.

F M GIORDANO *Paterson, N. J.*

CONTRIBUTIONS INVITED

Here are collected ideas that work, solutions to problems big and little that plague power men dealing with design, operation and maintenance. They range over the entire field—mechanical, electrical, hydraulic, structural, drafting-room practice, quick computing methods, operating procedures, maintenance elimination, testing.

Many POWER readers have ideas and techniques they have used successfully that ought to be passed along for everyone's benefit. POWER pays $20 for each accepted item.



SHOCK ABSORBER REDUCES MAINTENANCE

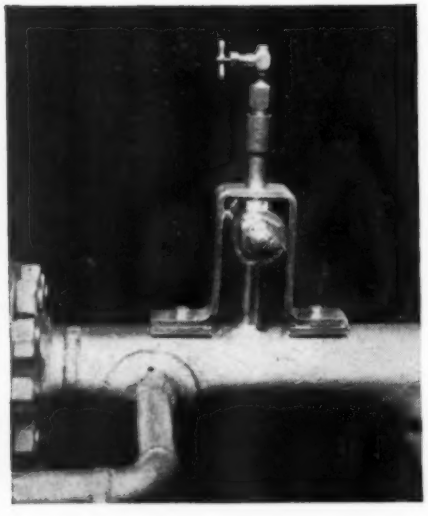
THE DRUM-TYPE COAL FEEDER for regulating supply to pulverizers, shown in the photo, has a spring-loaded leveling apron on the drum discharge side. This apron lifts to allow foreign objects—oversized coal, frozen lumps and the like—to pass through without jamming the feeder.

During winter months especially, handling an excessive amount of coal with these characteristics caused the leveling apron to lift often. At times it would return to leveling position under spring action with sufficient force to break the arms, shear-apron pins, or break the spring.

Several methods were tried to eliminate this destructive shock without success until a car shock absorber was used to slow down the apron return. The forward shock absorber of a late-model Ford automobile was found the easiest to adapt to the job. It requires only two capscrews tapped into the feeder casing to mount it. A link from the shock-absorber arm to the leveling-apron arm completes the installation. These parts are painted black in the illustration. By adjusting the shock absorber, the arm can be slowed down to any desired return speed, eliminating hammering and breakage.

Four of these arrangements have now been operating for a year without any trouble developing in the feeder parts or the shock absorbers. In addition, there is a saving in the cost of the repairs to the units.

DONALD H MCKAY
Great Works, Me.



VALVE-TAP BRACE PREVENTS BREAKAGE

GAS-TRANSMISSION LINES are customarily tapped at the upper surface for gage connections, as shown in the adjacent picture. A standard steel needle valve is usually provided below the gage-pressure control. As a safeguard against possible leakage a plug valve is also placed in the tap between the needle valve and the main line.

As considerable leverage may be needed to turn the protecting plug valve, one company places a guard rail around the small line. This rail takes the side twist of the plug valve when it is opened, and being fitted closely against the upper surface of the plug-valve body it also resists the end thrust.

Two pads of 3x⅝-in. steel, each equipped with ¾-in. studs, are welded to the main line as shown. A clamp of inverted U shape is set over the 1-in. branch line, with the legs so formed as to bring the device snugly against the valve when the nuts are pulled tight.

With this arrangement the weld or junction between main line and branch line is called upon to carry gas pressures only. This means the pressure-resisting parts do not have to be designed with a safety factor large enough to resist mechanical mishandling.

M H PEARCE *Carthage, Texas*

But make sure it's the right one.

An expert chess player gives careful study before making a move. In like manner, in choosing a water conditioning service, you should be sure to make the *best* move. You should choose a service based on sound engineering practice—there are no magic cure-alls. You should choose a service with a proved record . . . a service backed by ample engineering facilities.

W. H. & L. D. BETZ is an organization of engineers and chemists specializing in the solution of all industrial water problems. Years of experience have made Betz water conditioning service scientifically correct . . . complete . . . economical.

Our nationwide staff of engineers will welcome the opportunity of discussing with you this important subject of water conditioning . . . W. H. & L. D. BETZ, Gillingham and Worth Streets, Philadelphia 24, Pa. In Canada: Betz Laboratories, Limited, Montreal 1.

BETZ

BOILER WATER CONDITIONING • COOLING WATER CONDITIONING • INDUSTRIAL WASTE TREATMENT

PROBLEMS FROM THE PLANT

Exercise your engineering wits by submitting answers to this question, fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay

How Can I Save Steam From Curing Cylinders?

TO CURE CONCRETE BLOCKS we use six cylinders, each 65 ft long and 6 ft in diameter. The blocks are stacked in the cylinders, which are then filled with live steam. The curing cycle consists of cooking for 2 hr at 12 psi, then gradually bringing pressure up to 100 psi and cooking for 4 hr. Steam is then exhausted to atmosphere in about 40 min. Only two cylinders are cooking at one time; the others are being filled or emptied. Each operation takes about 1½ hr.

Steam is generated in an hrt boiler having 2000 sq ft of heating surface. We draw raw water from the Detroit River for feedwater. At times we do not use the feedwater pump because we cannot keep steam up with cold water going into the boiler. We tried using an injector but it wastes a lot of time.

At present we are using about 4½ tons of 12,000 Btu coal in 24 hr. Coal is fired by an underfeed stoker.

Can POWER readers suggest some way of using the exhaust steam so it will not be a total loss? I thought of using it to heat feedwater but don't know how to make use of it in the short exhaust period of 40 min out of each 12 hr. Maybe some engineer knows of a similar setup that has a good method for using waste steam. **H W, chief engineer.**

Readers' Answers

Why Does One Cooling Tower Take More Air?

(This question is from Nov issue with best answers from readers.)

We have two cooling towers, each designed to cool 1300 gpm of water from 105 to 85 F with a maximum wet bulb of 79 F. One is an induced-draft tower and the other a forced-draft.

The induced-draft tower is 18 ft wide, 32 ft long, and 25 ft high. It is equipped with three 7-ft disk fans operating at 325 rpm. Each fan, which has a 7½-hp motor, produces 46,300 cfm of air at ½-in. of water static pressure.

The forced-draft tower is 20 ft wide, 36 ft long and 26 ft high. It is equipped with two 11-ft aluminum-alloy adjustable blade fans operating at 250 rpm. Each of these fans requires 15 hp and gives 120,000 cfm of air at ½-in. pressure.

Decking of both towers is the same. It consists of six sets of 1½x6-in. rafters with 1x3-in. strips of wood, spaced 2ft, 3 in. apart and nailed on both sides of the rafters. Water is sprayed on the decking by 1½-in. nozzles at 5 psig.

I would like to know why the forced-draft tower requires about 72% more air and 30% more horsepower than the induced-draft tower.—**HB**

Calculate the Horsepower Output

A F-D TOWER REQUIRES more air because a certain amount of air handled is recirculated. Fans create a suction along the side of the tower, which tends to pull a certain amount of heated air from the top or exhaust side of the tower back to the inlet. Since this recirculated air does no cooling, or at best very little, it is necessary for the f-d tower to circulate more air.

The i-d tower naturally takes less power because the air is moving at a lower velocity. Another factor, which contributes to the power consumption of the f-d tower, is that air after leaving the fan must make a 90-deg turn, thus causing the fan to work against a higher head. This is not true in the i-d fan where the air is taken in at a lower velocity. Here, air makes the turn into the tower decking at low velocity. The fan discharge is directed in a straight line away from the tower.

Motor sizes are probably rated values, not actual horsepower consumed. I suggest that *HB* determine power actually used by each fan. Power input to each motor can be measured and the horsepower output calculated, using the input value and the motor efficiency. This latter can be obtained from the motor manufacturer's data. **Fred W Weisenbach, Wayne, Pa.**

Check Performance Of Both Towers

FIGURES GIVEN in the problem are design ratings only. *HB* should check actual power consumed by each tower. Compare water- and air-outlet temperatures, and relative humidities of outlet and inlet air for comparison.

Two manufacturers, or even one manufacturer at different times, may supply different towers to meet the same operating conditions. The nearest standard design at the time will be offered, and standard fans used. Also one manufacturer may provide a greater margin of safety as regards capacity, either as a matter of policy or a safeguard due to lack of experience. Again, higher power consumption with two fans may be compensated for by higher first cost and more maintenance of three fans. Motor sizes may give a false idea of the power, as motors are only made in a limited number of standard horsepower sizes. Thus, the three 7½-hp motors may be running overloaded but not enough to justify 10-hp motors; while the two 15-hp units may be consuming just enough power to make the use of 10-hp motors questionable.

An i-d cooling tower requires more power, not less, than a f-d. The exit velocity from the former is high, and is wasted power. But this reduces danger of recirculation of air. (See "Performance and Selection of Mechanical Draft Cooling Towers," by J Lichtenstein of Foster Wheeler Corp, in *Transactions, ASME*, October 1943.) An i-d fan passing the same weight of dry air as a f-d fan has to handle a greater weight of vapor and also a greater volume of air. This is the result of moisture and heat picked up by the air in passing through the tower, and also the draft loss in the tower. **W L Govan, Brantford, Ont.**

(*Continued on page* 116)

GAS COOLERS HAVE LONGER LIFE *with Anaconda* Arsenical Admiralty

HERE'S an interesting exchanger using extended surface for the more efficient cooling of gases. Built by the Griscom-Russell Company of New York, the heat transfer surface of this G-Fin Gas Cooler is made of Anaconda Arsenical Admiralty Alloy tubes and fins. The use of this alloy provides rust-proof, workable metal with special resistance to dezincification.

Arsenical Admiralty is but one of ten standard and several special Anaconda tube alloys for heat exchange applications. To help you select the alloys best suited for your needs, our Technical Department will be glad to assist you and make recommendations. Also, write for your copy of Publication B-2, which provides detailed information. 48129

The heat transfer elements of this G-Fin exchanger consist of seamless tubes with longitudinal fins equally spaced about the circumference. Admiralty Alloy fins are thoroughly bonded to Arsenical Admiralty Alloy Tubes by a special mechanical process. This design gives six to eight times as much outer as inner surface—facilitating the transfer of heat from gas to cooling fluid.

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General Offices: Waterbury 88, Connecticut

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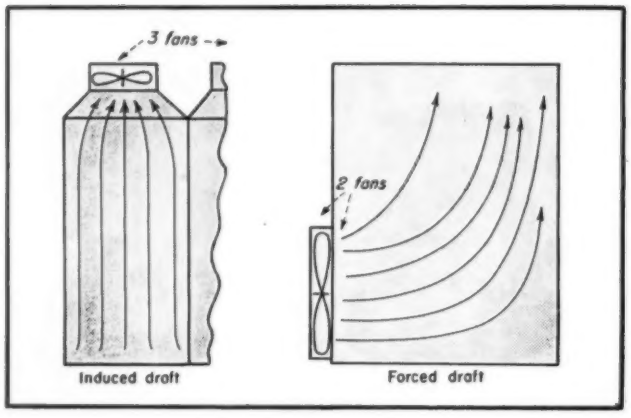

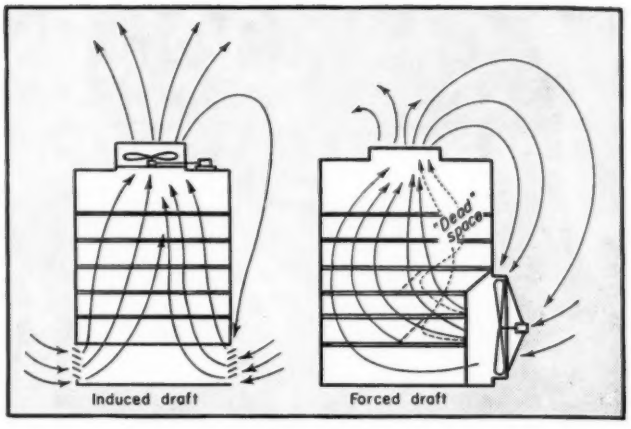

Turbulence Affects Forced-Draft Tower

FIRST, CONSIDER the i-d tower in the sketch above. For practical purposes, the construction of this tower, with three fans, is such that it can be considered as three small separate towers, only one of which is shown. The air enters the tower at the very bottom, and rises with practically uniform velocity throughout the cross section until it is funneled into the fan. In a well-designed cooling tower, this results in the air being discharged at its maximum heat-absorbing capacity, thus requiring a minimum of air and power to operate the fans.

Now examine the f-d cooling tower. Air here is discharged from two horizontal cylinders, whose centers are several feet above the bottom of the tower. Inside the tower, the two columns of air break up, causing great turbulence, which results in some recirculation of air and some pockets of dead air with little or no circulation. Although the decking does tend to break up the air currents as they move up toward the top, there is not the same uniformity of velocity of air throughout the cross section as there is in the i-d tower. Therefore, since the full heat-absorbing capacity of all the air supplied by the f-d fans cannot be utilized, an excess of air must be supplied to accomplish the same amount of cooling. This, in turn, requires fans of larger capacity and more horsepower to operate them. **Howard T Livingston, Los Angeles, Calif.**

Induced-Draft Towers Have Higher Efficiency

HB'S PROBLEM is one of design and not operation. F-d cooling-tower fans require more air and, hence, more horsepower for several reasons. Some air discharged from a f-d tower descends to the ground and enters the intake again. This recirculation of air cannot be entirely prevented, and is usually attributed to high-velocity inlet and low-velocity exit.

I-d towers discharge cooling air at a high velocity. This air travels a considerable distance upward before mixing with the surrounding atmosphere. In addition, heat transfer between the water to be cooled and the cooling air is better in the i-d tower because there is less stratification of the air. With minimum stratification the cooling effect is uniformly produced across the entire cross section of the tower. Air generally enters from all sides of the i-d tower. This results in a more desirable flow of air across the descending water.

F-d towers have been in use longer than i-d type, but the proved higher efficiency of the i-d tower has made it more popular in the last ten years. **Tyler G Hicks, New York, N. Y.**

Dead Spots Cause Trouble

ON COMPARING the performance and specifications of the i-d and f-d towers, I find they are operating under water-load concentrations of 2.46 gpm/ft^2 and 1.81 gpm/ft^2 respectively. Assuming that all other characteristics are the same, this would indicate that the f-d tower should require less air than the i-d unit. Within reasonable limits, required air flow decreases as the water-load concentration decreases. It may be that more air is being used on the f-d tower than is necessary to cool the air to the required temperature.

If *HB* has not already done so, I suggest he decrease the pitch on the two 11-ft fans to determine whether the f-d tower matches the performance of the i-d tower at an air flow of less than 120,000 cfm per fan. This would reduce the power consumption of the 11-ft fans. If the full 120,000 cfm per fan is required to obtain design conditions, the tower is probably a victim of air recirculation or improper air distribution, or both.

Air recirculation is the effect of warm, humid air from the vents descending into the fan intakes. When recirculation occurs the tower is supplied with air of a higher wet-bulb temperature than the prevailing air. Therefore, more air is required for cooling.

A difference in construction of the two towers results in improper air distribution on the f-d tower unless it is properly baffled. Drawing all air in from one side and discharging it toward the opposite side results in a "dead" space, as shown in sketch above. This condition is bad unless the tower is baffled so as to distribute the air as evenly as possible. To meet performance conditions, more air than normal must be put through the tower to offset reduced effective area.

I suggest *HB* take wet- and dry-bulb temperatures at air intake of both towers to determine whether recirculation is taking place. Higher wet-bulb readings at the intakes than those read some distance from the tower indicate air recirculation. Internal inspection of the f-d tower indicates whether baffles are in place, or should be installed.

The additional horsepower required on the f-d tower is due to the additional air moved. The data given indicate that the f-d fans are delivering approximately 29% more air in cfm per hp than the i-d fans at the same static pressure, and are, therefore, more efficient. **Charles A Schaeffer, Jr, Houston, Texas.**

(*Continued on page* 136)

an ⋔ "reason why"

⋔ stands guard at danger spots

A road-block stops the flow of traffic . . .

Until the danger is past.

An ⋔ Turbine Protection System stops flow, too . . .

Stops flow of h. p. steam to turbine . . .
Stops back-flow of l. p. steam . . .
And relieves excess pressure . . .
In extraction line.
It stands guard at danger spots.

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Performs a particular function . . .
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Bulletin 8K contains detailed information . . .

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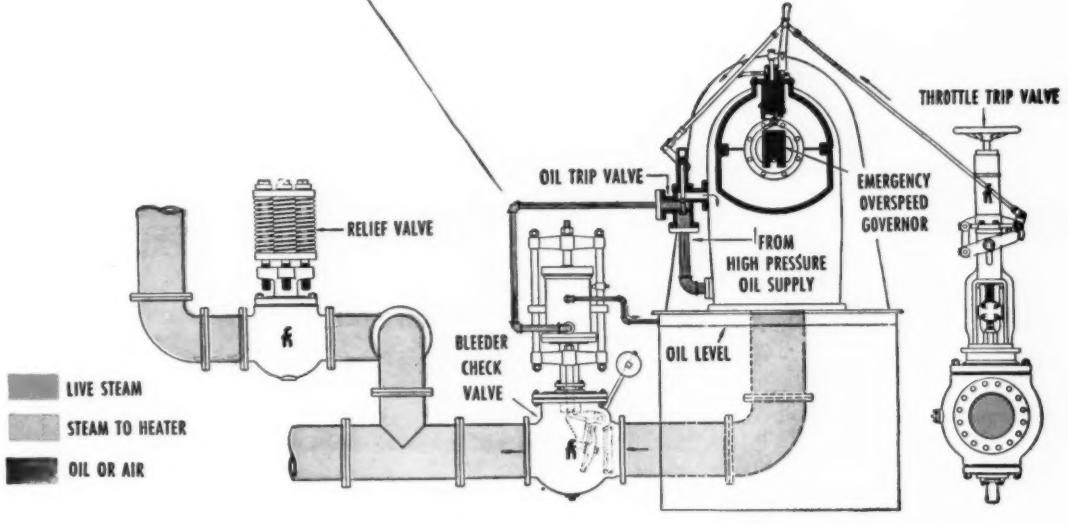

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WHAT'S New IN PLANT EQUIPMENT

Electronic Speed Control E28

REGUTRON PROVIDES EXCITATION and speed control, through a magnetic drive, of boiler-draft fans, centrifugal pumps, compressors and blowers. It rectifies 3-phase power to energize the magnetic drive and adjust excitation current to hold output shaft speed to within ± 1%. Load speed is selected automatically or manually by positioning a small potentiometer. Other parts of the control guard against effects of overvoltage, undervoltage, short-time power failure, improper operating tubes and amplifier. Excitation current is balanced against voltage of a tachometer generator driven by the load; therefore speed is held constant despite changes in prime-mover speed or changes in load or power-supply voltage. **Electric Machinery Mfg Co, Minneapolis 13, Minn.**

Transformer Release E29

THIS COVER-MOUNTED mechanical release device vents internal transformer pressures caused by electric arc or overload. It works quicker and more effectively than the present device that depends upon rupturing a diaphragm. It fits any transformer with a 9-in. handhole opening. Adapters can be used for fitting it to larger openings, if necessary.

The device withstands full vacuum for transformers designed for filling under a vacuum. A locking device is also available so tank can be pressure tested in factory or field. A roller latching arrangement locks vent tightly until the tank reaches pressure for which the device is set, when it trips the vent fully opened. It can be set for 10 psi, and tripping takes place within ½ psi of this setting. A dome over opening prevents rain from entering transformer, even after it has operated. Resetting after operation is simple and requires no replacement parts other than new gaskets that can be made in field. **Westinghouse Electric Corp, Box 868, Pittsburgh 30, Pa.**

Test Instrument E30

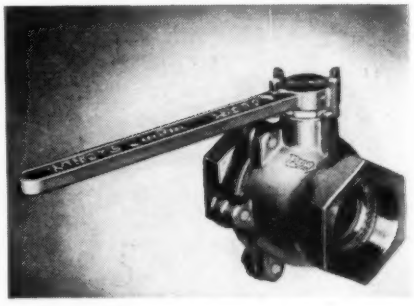
DESIGNATED AS MODEL 1005 electrical laboratory, this instrument is a complete test unit for electronic and electrical technicians in laboratories, shops or service departments. It combines the functions of over 60 separate instruments and contains six individual instruments, each with a complete set of ranges.

In addition to a wide variety of ac and dc voltage and current ranges, it has a multistage ohmmeter and a single-phase wattmeter. For extreme sensitivity, it has a 50 microammeter providing 20,000 ohms per volt on all dc ranges.

This electrical laboratory is adaptable for testing all electrical appliances, small motors, circuits, radio sets, etc. **Simpson Electric Co, 5208 W Kinzie St, Chicago, Ill.**

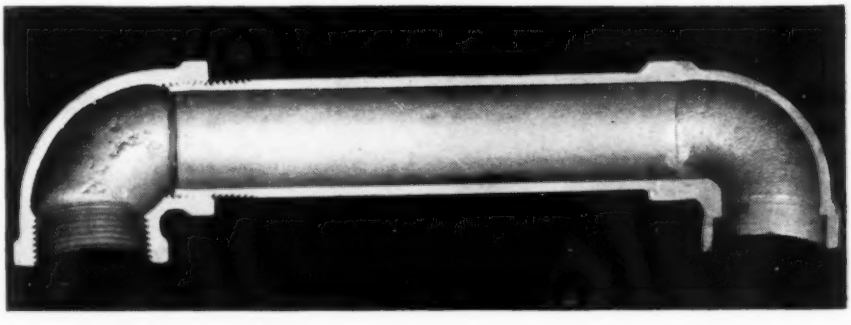
Cooling Tower E31

INDUCED-DRAFT COOLING TOWER is of cell-type construction for easy erection and maintenance. It is equipped with multiple fans. New features permit compactness, low pumping head, and automatic control of off-peak loads. Metallic connectors and tierods are concealed. Towers are available in sizes from 75- to 2000-gpm capacity. **Refrigerating Machinery Co, 525 Market St, San Francisco 5, Calif.**



Ball Valve E32

ROCKWOOD BALL VALVE is for service on pipelines where full flow, tight seal and quick opening or closing is desired. The floating ball in combination with resilient synthetic-rubber seat allows abrasive particles to be automatically wiped clear of seating surface without injury to ball or seat. When closed, pressure of fluid automatically positions ball against seat to form a tight seal. Proper alignment of ball and seat does not depend upon mechanical parts. Valve is available in bronze with screwed ends in all pipe sizes from ¼ to 2 in. for 150-psi working pressure. **Rockwood Sprinkler Co, 38 Harlow St, Worcester 5, Mass.**



Malleable Brazed Fitting E33

FLAGG-FLOW THREADLESS FITTING is the first black malleable fitting ever produced for brazing to steel or wrought-iron piping. Brazed into machined socket in fitting, piping end is flush with shoulder.

Photo contrasts streamlined brazed joint (right) with screwed joint.

To insure streamlined-fluid flow, outside of pipe end is clean and surfaced by special tool. After pipe is positioned in socket, fitting is torch heated until silver-brazing alloy flows in by capillary action to form a seamless, permanently bonded joint. Brazing alloy flows naturally to all parts of the joint even where piping is close to a wall or machine so that fitting can be heated from one side only. To remove fitting merely reheat.

Flagg-Flow fittings are designed particularly for pipes 2 in. and smaller, where

Use convenient reply cards on page 178a to secure additional information on these new equipment items. Please be sure to identify your request with the new-equipment key letter, *E*, and number, as shown on the items above.

All piping equipment . . . All pre-fabrication . . . on One Order to CRANE

ONE
SOURCE OF SUPPLY
RESPONSIBILITY
STANDARD OF QUALITY

Pipe fabrication of every sort is Crane Co.'s business. From a simple bend to the most complex welded assembly, your design is assured of precise fabrication. Fully equipped, skillfully manned and strategically located, five Crane Pipe Shops are at your service.

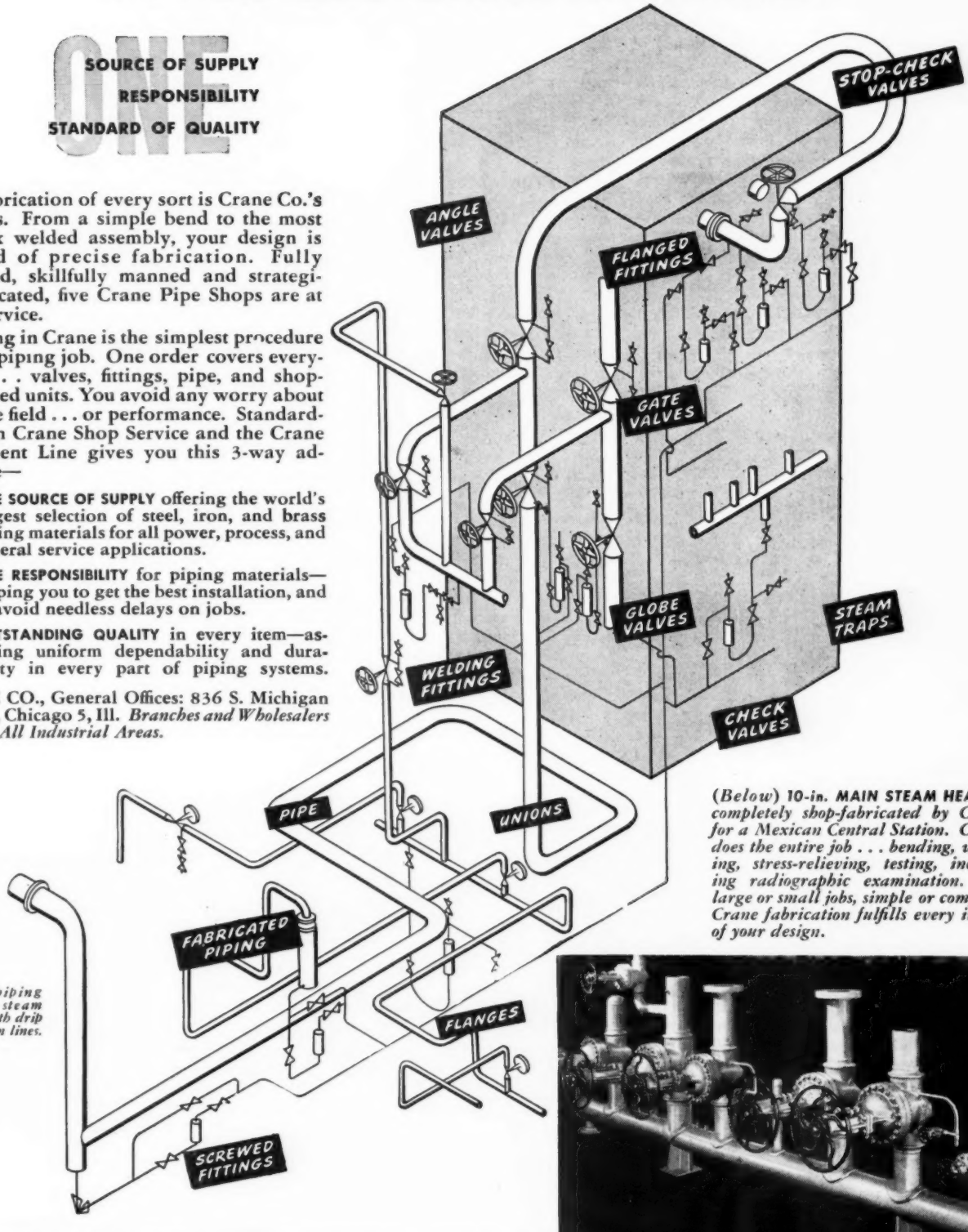
Calling in Crane is the simplest procedure on any piping job. One order covers everything . . . valves, fittings, pipe, and shop-fabricated units. You avoid any worry about fit in the field . . . or performance. Standardizing on Crane Shop Service and the Crane Equipment Line gives you this 3-way advantage—

ONE SOURCE OF SUPPLY offering the world's largest selection of steel, iron, and brass piping materials for all power, process, and general service applications.

ONE RESPONSIBILITY for piping materials—helping you to get the best installation, and to avoid needless delays on jobs.

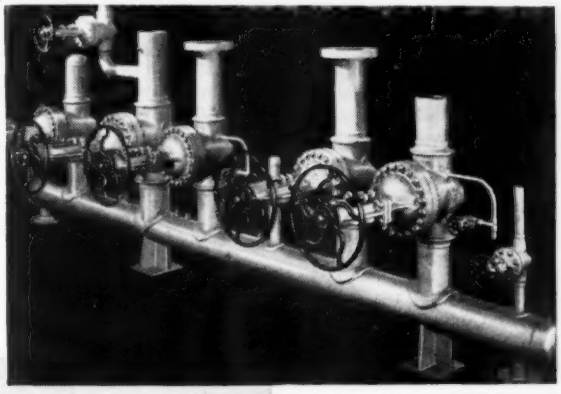
OUTSTANDING QUALITY in every item—assuring uniform dependability and durability in every part of piping systems.

CRANE CO., General Offices: 836 S. Michigan Avenue, Chicago 5, Ill. *Branches and Wholesalers Serving All Industrial Areas.*



Boiler piping showing steam mains with drip and drain lines.

(*Below*) **10-in. MAIN STEAM HEADER** *completely shop-fabricated by Crane for a Mexican Central Station. Crane does the entire job . . . bending, welding, stress-relieving, testing, including radiographic examination. On large or small jobs, simple or complex, Crane fabrication fulfills every intent of your design.*



EVERYTHING FROM . . .

VALVES • FITTINGS
PIPE • PLUMBING
AND HEATING

CRANE

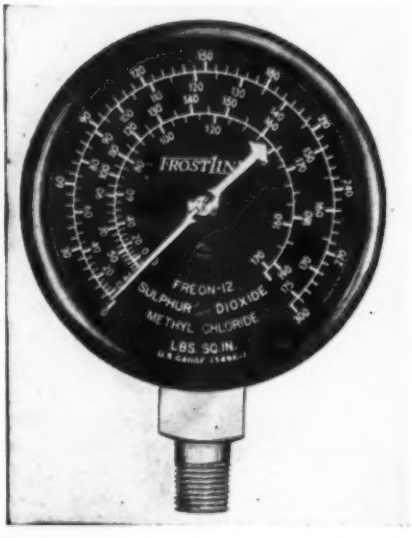
FOR EVERY PIPING SYSTEM

welding has been less widely used, rather than for larger pipe sizes.

Eliminating thread cutting, *Flagg-Flow* suggests future economies by the use of thinner steel and wrought-iron piping, particularly for low-pressure applications.

Proposed applications include hot- and cold-water lines, steam and fuel-oil piping, meter and instrument lines, boiler feed lines, lubricating-oil piping, gas and air piping, hydraulic systems not over 300 psi, radiant-heating coils, cut in concrete floor, and process piping where iron or steel pipe is applicable in industry.

Normally, upper limits are 150-psi working steam pressure at 450 F, or 300-psi for non-shock oil, water or gas lines at 150 F. **Stanley G Flagg & Co, 1421 Chestnut St, Philadelphia 2, Pa.**

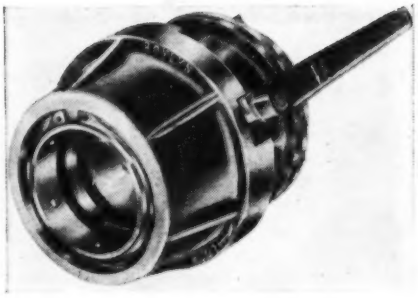


Pressure Gages E34

NEW GROUP OF FROSTLINE GAGES are specifically designed for refrigeration industry. They include both high- and low-side instruments with or without a temperature equivalent dial scale. Design features include an adjustable pointer, large easy-to-read dials with 1-in. graduations, and luminous treatment of dials and pointers for greater legibility in semi-darkness. Available in sizes standard to the industry. **U. S. Gauge Div, American Machine & Metals, Inc, Sellersville, Pa.**

Electric Welder E35

HORNET 36A motor-generator arc-welding machine is available in 200-, 300-, and 400-amp models. It is smaller in size and weighs one-third less than previous *Hornet* models. Welder is designed for either 220 or 440 v. **Wilson Welder & Metals Co, Dept 1609P, 60 E 42nd St, New York 17, N. Y.**

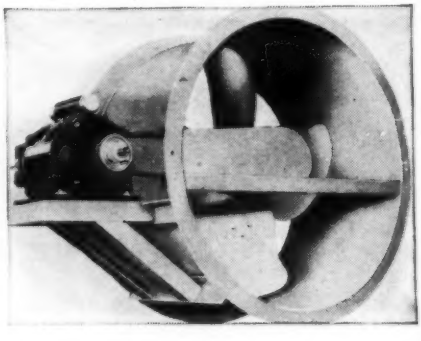


Trip-Proof Coupling E36

POSITIVE SHUTOFF VALVE combines with quick pipe coupling by meshing a valve lever with locking collar of coupling. Valve must be in shutoff position before coupling can be broken and coupling must be locked to its mating nipple before valve can be opened. It is available in 2½-in. pipe thread sizes for handling chemicals, petroleum products and other liquids where spillage is not permissible or desirable. **Roylyn, Inc, 718 W Wilson Ave, Glendale 3, Calif.**

Compressor Control E37

SOLENOID-OPERATED VALVE provides complete automatic control of water supply to water-cooled compressors. Solenoid valve is direct operated, it has no auxiliary pistons. It handles temperatures up to 400 F, and in some sizes will operate under differential pressures up to 150 psi. Connections can be arranged so that compressor will not start until water flow completes an electric circuit through an electrode mounted in the discharge line. If water flow stops while the compressor is operating, machine will stop immediately. **Johnson Corp, Three Rivers, Mich.**

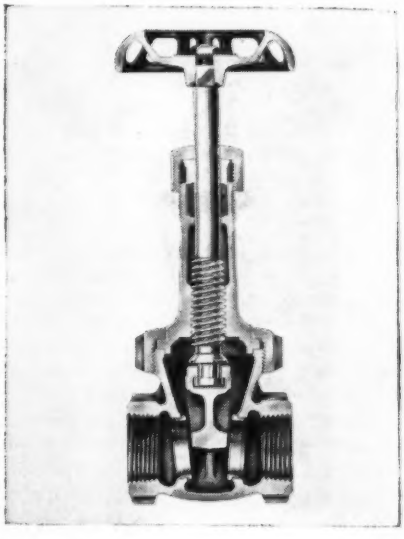


Booster Fan E38

SERIES DXB BOOSTER FANS are available in capacities from 2000 to 9500 cfm. Fan shafts and motors are ball-bearing mounted for smooth operation and long life. Fan is designed for either vertical or horizontal mounting. Blades are of nonferrous metal. All ratings are certified by the Propeller Fan Manufacturers Assn. **Chelsea Fan & Blower Co, Inc, 1200 Grove St, Irvington, N. J.**

Ac Voltage Recorder E39

PRODUCING A HIGHLY LEGIBLE RECORDING, this instrument can accommodate as many as 16 different ac voltages on a wide strip chart. Unusual readability of scale results from a depressed zero range that ignores lower portion of voltage scale, in which operator is not interested. It spreads volts or kilovolts, which he needs to watch, across instrument's entire chart width. These ac voltage recorders are basically dc potentiometer instruments. They use a thermal converter as a metering element. Standard ranges are available to cover the usual bus, transmission and distribution voltages. **Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia 44, Pa.**



Gate Valve E40

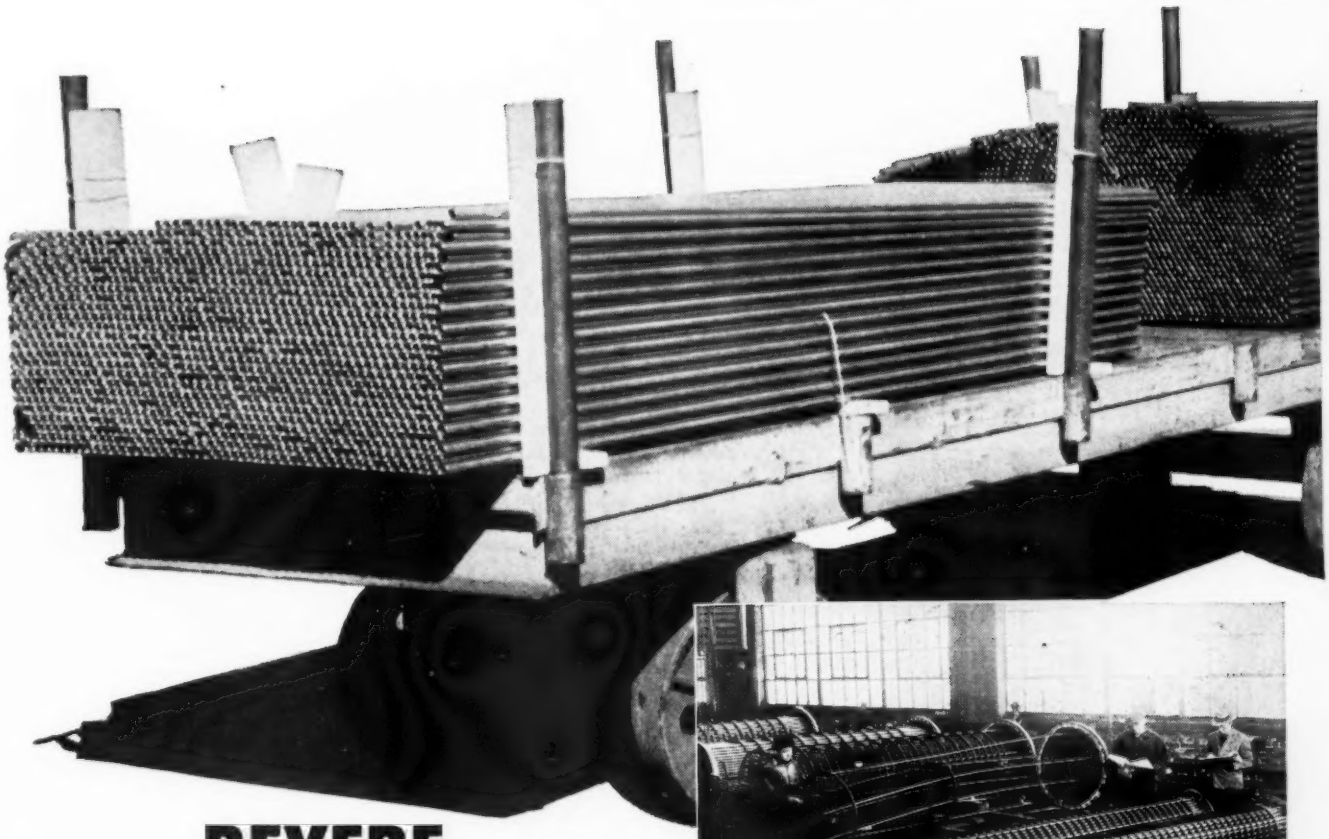
BRONZE GATE VALVE, Fig. 270-*U*, for 200-psi service, has a high-tensile strength bronze wedge seating against *monel* metal seat rings of a hardness of about two and one-half times that of the valve-body bronze. Seat rings are expanded into body and are equivalent to integral faces. Wear is taken by the bronze wedge, which can be replaced by simply slipping it off the stem and putting on a new one. Threads on manganese-bronze spindle are longer and larger in diameter, which reduces wear to a minimum and insures easy operation. A deeper stuffing box holds more packing, prevents leakage, and assures friction-free spindle operation. Valve is available in sizes from ¼ to 2 in. **Jenkins Bros, 80 White St, New York 13, N. Y.**

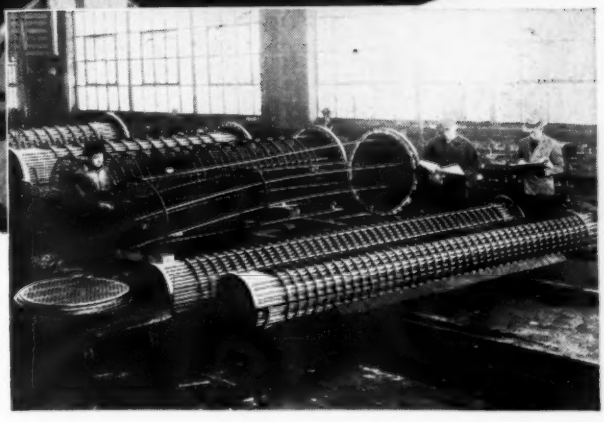
Plug-In Panelboard E41

PLUG-IN FEATURES of this panelboard permit easy and speedy removal or insertion of multibreaker units for future changes in circuit ratings, or for additional circuits. Breaker units are mounted on silver-surface

Use convenient reply cards on page 178a to secure additional information on these new equipment items. Please be sure to identify your request with the new-equipment key letter, *E*, and number, as shown on the items above.

MEETING SPECIAL CONDITIONS





REVERE

REVALON and CUPRO-NICKEL

Because each condenser and heat exchanger presents its own special combination of conditions, no blanket recommendations for condenser tube alloys are possible. However, this much can be stated authoritatively: there are three Revere Metals which deserve special consideration in cases of limited or unsatisfactory tube life. Here they are:

Cupro-Nickel, 30%. Withstands high operating temperatures. A tenacious surface film forms on this metal, which resists impingement attack and erosion, salt water, and waters containing organic material. Widely used in marine and seaboard installations, the tropics and subtropics.

Cupro-Nickel, 20%. Similar to Cupro-Nickel, 30%, but lower in price and somewhat less resistant to certain types of corrosion.

Revalon (Aluminum Brass). This Revere Metal contains a small proportion of aluminum, which gives it a long life in applications where water velocities are high or water is saline. The film formed on this tube is tenacious and self-healing, rendering it highly resistant to impingement attack.

Which of these types to select, or which of the five other types of Revere Condenser Tubes should be chosen, depends on individual conditions. The Revere Technical Advisory Service will gladly collaborate with you in arriving at a decision as to the most economical tubes for your plant.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N.Y.—Sales Offices in Principal Cities, Distributors Everywhere.

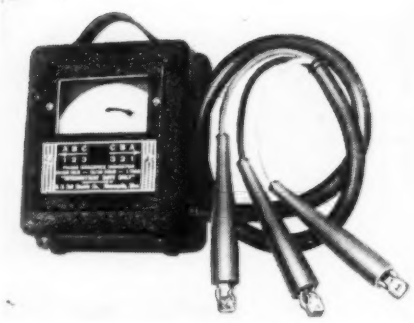
busbars by positive-pressure contact jaws. High-speed coilless magnetic and thermal trip of the *MO4* breaker gives adequate time lag for starting motors and tungsten lamps inrush current. It trips as fast as one-hundredth of a second at current values slightly above operating range. Breaker units regularly provide four single poles that can be readily converted into two double poles by insertion of handle ties. *NMO* panelboards are furnished 100- and 200-amp main-circuit ratings, 120/240-v ac with 15-, 20- and 30-amp circuits. **Square D Co, 6060 Rivard St, Detroit 11, Mich.**

Position Recorder E42

CAPABLE OF RECORDING almost any mechanical motion or position, this instrument uses a 10-in. circular chart and inking pen operated from a remote point by a self-synchronous motor. By a single adjustment, inking pen moves the full chart range with any desired motion of self-synchronous motor within a range of ½ revolution up to 10 revolutions. This feature permits a high accuracy and makes possible remote recording of such variables as pressure, temperature, flow and many mechanical movements. **Servo-Tek Products Co, 247 Crooks Ave, Clifton, N. J.**

Utility Fan E43

CHELSEA TYPE AA utility fan is suitable for cold-storage, milk-cooling, meat-storage and quick-freezing rooms, and for eliminating dampness by air circulation. Totally enclosed motor is equipped with ball bearings so that unit can be operated in any position. Available in 3000- and 4800-cfm capacity. **Chelsea Fan & Blower Co, 1206 Grove St, Irvington 11, N. J.**

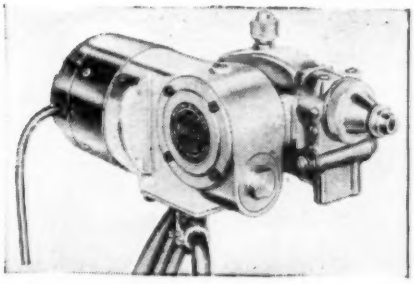


Phase-Rotation Indicator E44

COMPACT AND LIGHTWEIGHT, this self-contained instrument, known as the *Selco* phase-rotation indicator, is for electrical power companies, industrial-plant electricians, electrical contractors, manufacturers of electrical equipment, and others who need a quick, positive phase-rotation indicator. It can be used for "phasing out" new equipment, such as transformer banks and alternators for parallel operation. It can also be used for reestablishing disrupted service and on installation of motors and condensers. It indicates phase sequence by numerical, alphabetical, color coding and CW-CCW methods. It is designed to operate between 50 and 600 v, 25 to 120 cycles on 2-, 3- or 4-phase circuits. **H H Sell Electric Co, 1907 Willow Ave North, Minneapolis 11, Minn.**

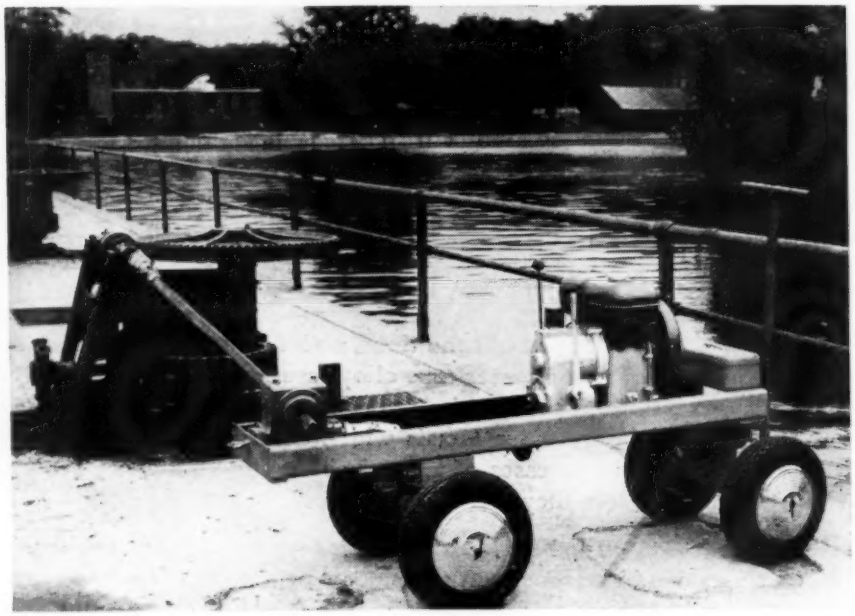
Test Tube E45

TRUTEST COMBINATION phosphate mixing and testing tube has been developed for use in water analyses. Tube carries graduated markings for test sample and chemical to be added. Tube fits any TruTest comparator block or Taylor slide. **TruTest Laboratories, Inc, 20 S. 33rd St, Philadelphia 4, Pa.**



Metalizing Gun E46

MOGULECTRIC METAL-SPRAY GUN is powered with a 1/20-hp. constant-speed induction motor, thereby assuring a uniform wire speed. By using different combinations of gearing, most any spraying speed can be obtained with any of the metals used in the metallizing industry. Electric motor reduces air requirements. **Metallizing Co of America, 1330 W Congress St, Chicago 7, Ill.**



Portable-Gate Operator E47

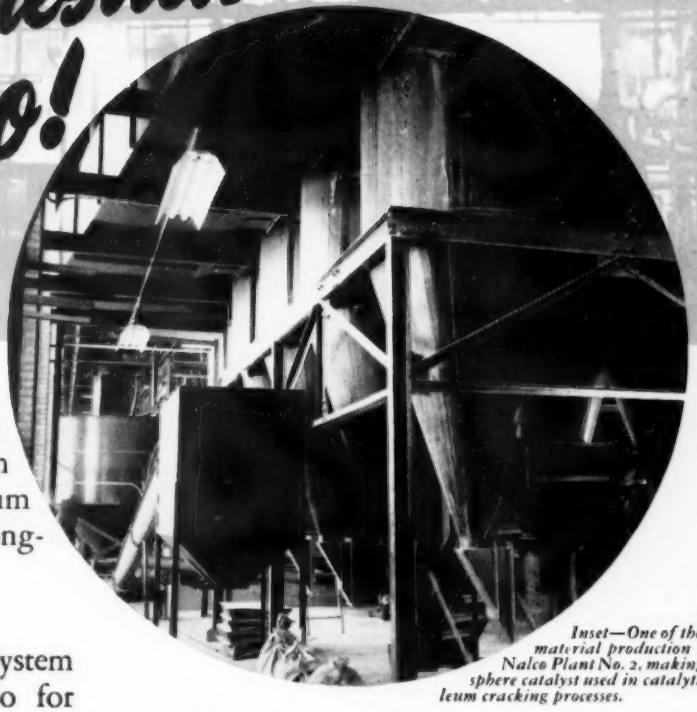
POWER-DRIVEN tractor-type portable gate operator is on pneumatic-tired wheels. Gate operator is available in three models: electric-motor driven, 5- and 10-hp gasoline-engine driven. Gasoline-engine driven unit is most generally used because it has its own power plant. Usually electric unit is used around filtration, pumping and sewage-treatment plants where electrical-power outlets are readily available. Principal application is in general maintenance of 10- to 36-in. gates operating in balanced flow. Operation is smooth and simple;

(*Continued on page* 154)

Use convenient reply cards on page 178a to secure additional information on these new equipment items. Please be sure to identify your request with the new-equipment key letter, *E*, and number, as shown on the items above.

in the PETROLEUM INDUSTRY

permanent water treatment results by Nalco!



Inset—One of the special material production lines at Nalco Plant No. 2, making microsphere catalyst used in catalytic petroleum cracking processes.

For a quick estimate of water treatment results the Nalco System is getting throughout the Petroleum Industry, check this record of long-term usage . . .

51% of all Nalco System refineries have been using Nalco for more than *5 years!*

44% of the above refineries have been sure of Nalco water treatment results for *over 10 years!*

42% of refineries in the over-10-years group have enjoyed Nalco Service *over 15 years!*

Here is positive evidence that the progressive Nalco System produces **permanently successful water treatment results** . . . in large and small installations. You can get the same trouble-free Nalco System working in your plant on short notice—Write for details today.

NATIONAL ALUMINATE CORPORATION

6222 W. 66th Place, Chicago 38, Illinois

Canadian inquires should be addressed to Aluminate Chemicals, Ltd.
555 Eastern Avenue, Toronto 8, Ontario

Nalco

– the Scientific System of Water Treatment for All Industry

How to plan

COMMERCIAL LAUNDRY WASHER PIPING

Another in the series of basic piping layouts prepared by Jenkins Bros.

Commercial laundries, as well as hospitals, colleges, hotels and institutions, commonly use the washer piping hookup illustrated here. It provides the usual hot and cold water and steam connections to a battery of washers: Although actual installations may differ widely in complexity, size and method of operation, this diagram shows control points where valves are essential to any soundly engineered installation.

Waste from washers drains into a common trench, which in turn drains into a heat reclaimer. Cold water which is to be heated first passes through a series of coils in the heat reclaimer where it is preheated. This utilization of heat from the hot wastes before they are discharged to the sewers improves plant efficiency.

The hot water tank is fitted with two heating coils. The primary coil is supplied with the low pressure exhaust steam from the various steam power units such as pumps, engines and turbines. This coil is generally sufficient to heat water for the periods of operation when the hot water requirements are low. An auxiliary heating coil supplied directly with high pressure steam from the boiler is thermostatically controlled to heat the water during peak demands.

Jenkins PRACTICAL PIPING LAYOUTS 31

Illustrating the proved 3-point formula for trouble-free, time-defying hookups

A Use the right type valve for the service.
B Place valves correctly in the line.
C Choose Jenkins Valves for lifetime economy.

Other types and pressure ranges of Jenkins Valves can be used for this type of layout according to the factors involved. Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation.

Copies of Layout No. 31 will be furnished on request. Mail coupon.

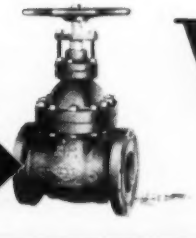
Figure 720, the Jenkins Bronze Rapid Action Globe Valve with catch-open lever, is recommended for use in laundry and other services where quick on-and-off action is required. It can be opened with ease and remains open without need of set screws or other locking devices. It prevents waste, and overcomes objectionable water hammer and shock.

A CHOICE OF OVER 500 JENKINS VALVES

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from the Jenkins Catalog. It's your best assurance of *lowest cost in the long run.*

Jenkins Bros., 80 White Street, New York 13; Bridgeport, Conn.; Atlanta; Boston; Philadelphia; Chicago; San Francisco.
Jenkins Bros., Limited, Montreal.

JENKINS VALVES



LOOK FOR THE DIAMOND MARK
SINCE 1864

TRADE JENKINS MARK

125 TO 600 LBS. STEAM PRESSURE

BRONZE * IRON * STEEL

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SOLD THROUGH RELIABLE INDUSTRIAL DISTRIBUTORS EVERYWHERE

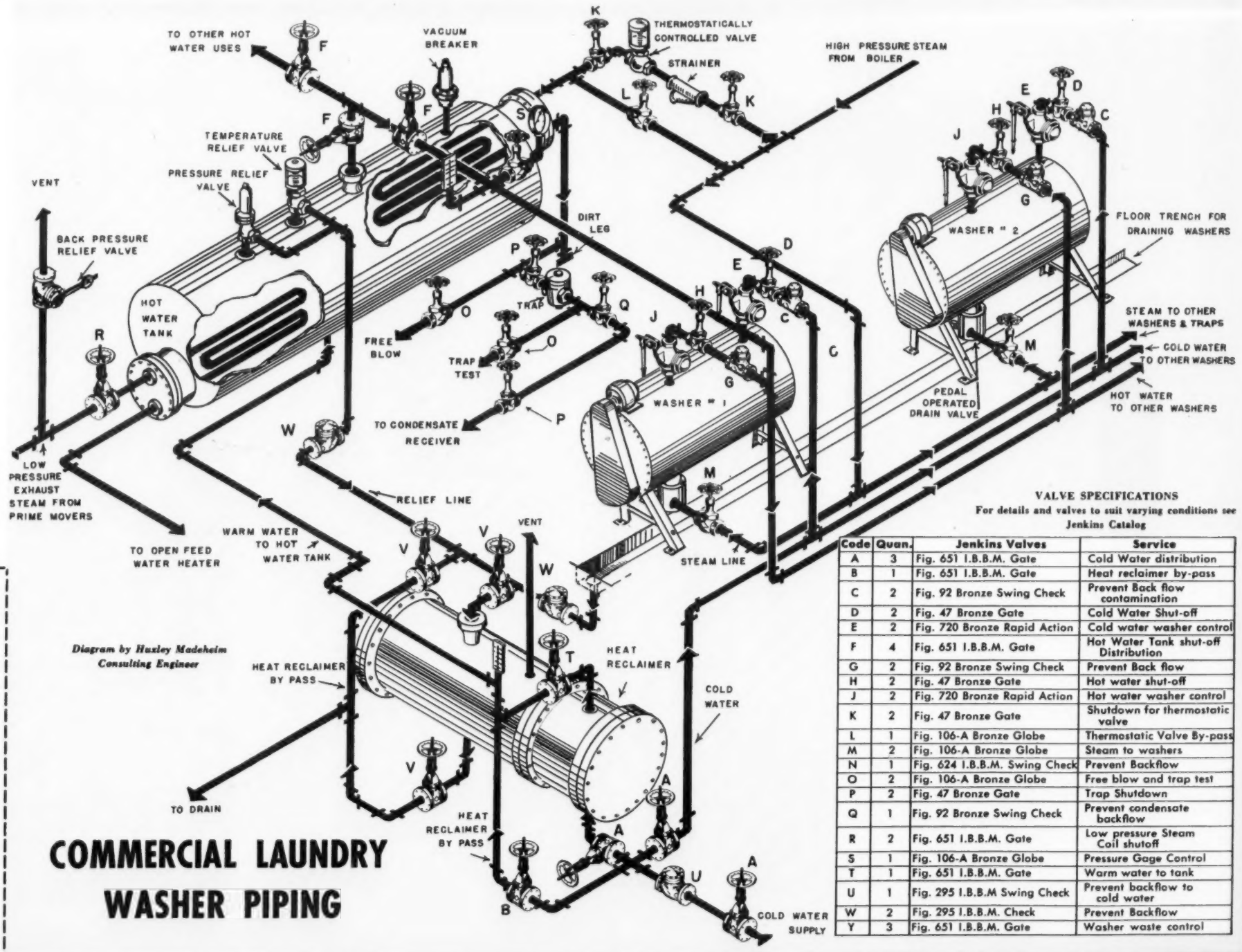


Diagram by Huxley Madeheim
Consulting Engineer

COMMERCIAL LAUNDRY WASHER PIPING

VALVE SPECIFICATIONS
For details and valves to suit varying conditions see Jenkins Catalog

Code	Quan.	Jenkins Valves	Service
A	3	Fig. 651 I.B.B.M. Gate	Cold Water distribution
B	1	Fig. 651 I.B.B.M. Gate	Heat reclaimer by-pass
C	2	Fig. 92 Bronze Swing Check	Prevent Back flow contamination
D	2	Fig. 47 Bronze Gate	Cold Water Shut-off
E	2	Fig. 720 Bronze Rapid Action	Cold water washer control
F	4	Fig. 651 I.B.B.M. Gate	Hot Water Tank shut-off Distribution
G	2	Fig. 92 Bronze Swing Check	Prevent Back flow
H	2	Fig. 47 Bronze Gate	Hot water shut-off
J	2	Fig. 720 Bronze Rapid Action	Hot water washer control
K	2	Fig. 47 Bronze Gate	Shutdown for thermostatic valve
L	1	Fig. 106-A Bronze Globe	Thermostatic Valve By-pass
M	2	Fig. 106-A Bronze Globe	Steam to washers
N	1	Fig. 624 I.B.B.M. Swing Check	Prevent Backflow
O	2	Fig. 106-A Bronze Globe	Free blow and trap test
P	2	Fig. 47 Bronze Gate	Trap Shutdown
Q	1	Fig. 92 Bronze Swing Check	Prevent condensate backflow
R	2	Fig. 651 I.B.B.M. Gate	Low pressure Steam Coil shutoff
S	1	Fig. 106-A Bronze Globe	Pressure Gage Control
T	1	Fig. 651 I.B.B.M. Gate	Warm water to tank
U	1	Fig. 295 I.B.B.M Swing Check	Prevent backflow to cold water
W	2	Fig. 295 I.B.B.M. Check	Prevent Backflow
Y	3	Fig. 651 I.B.B.M. Gate	Washer waste control

JENKINS BROS., 80 White St., New York 13, N. Y.

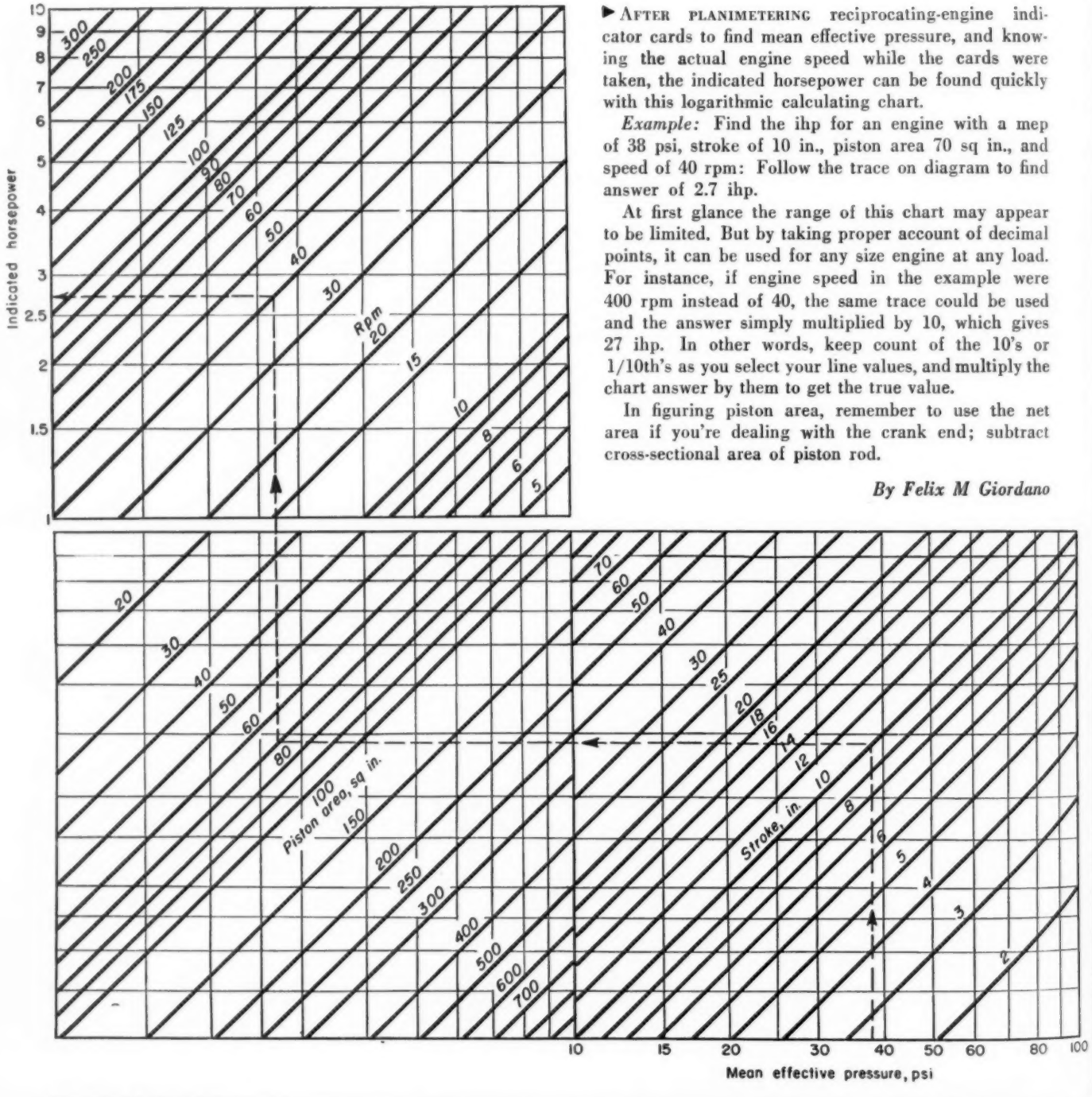
Please send me a reprint of Piping Layout No. 31.

Name.....
Company.....
Address.....

POWER'S DATA SHEETS

Number 187

Engine Indicated Horsepower



► AFTER PLANIMETERING reciprocating-engine indicator cards to find mean effective pressure, and knowing the actual engine speed while the cards were taken, the indicated horsepower can be found quickly with this logarithmic calculating chart.

Example: Find the ihp for an engine with a mep of 38 psi, stroke of 10 in., piston area 70 sq in., and speed of 40 rpm: Follow the trace on diagram to find answer of 2.7 ihp.

At first glance the range of this chart may appear to be limited. But by taking proper account of decimal points, it can be used for any size engine at any load. For instance, if engine speed in the example were 400 rpm instead of 40, the same trace could be used and the answer simply multiplied by 10, which gives 27 ihp. In other words, keep count of the 10's or 1/10th's as you select your line values, and multiply the chart answer by them to get the true value.

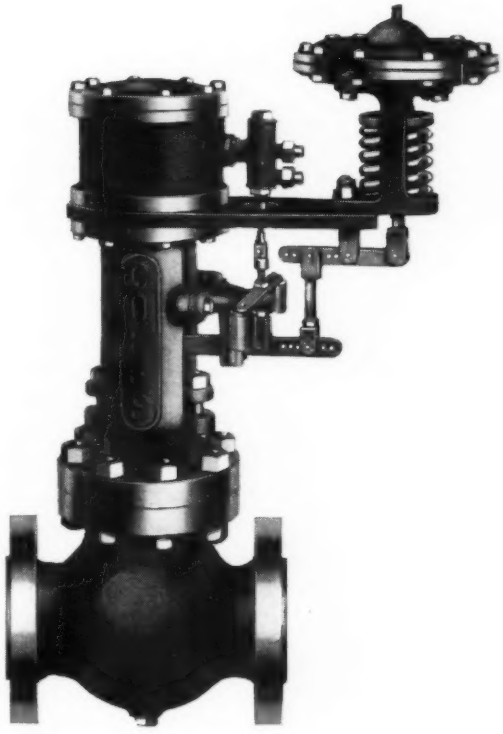
In figuring piston area, remember to use the net area if you're dealing with the crank end; subtract cross-sectional area of piston rod.

By Felix M Giordano

© POWER

For more exacting

PRESSURE REDUCING JOBS



Type R-DSLH, relay-operated for remote control
Below: Type DBI is direct-operated and self-contained

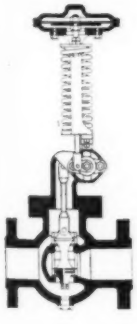
COPES Pressure Reducing Valves are designed for tough jobs demanding greater accuracy and dependability than can be obtained with ordinary stock valves. They are built to give as good results under emergency conditions as in normal service—to avoid objectionable vibration, noise and wear. Each is engineered for the individual installation, to assure close pressure control and long service life with minimum maintenance.

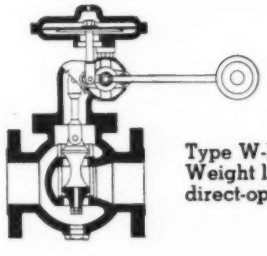
The COPES line is complete, covering a controlled pressure range from 27 inches of mercury vacuum to 600 psig. Valves are direct- or relay-operated, self-contained or actuated by a master control—as dictated by the individual operating conditions. Write for Bulletin 477.

ENGINEERED BY THE MAKERS OF COPES

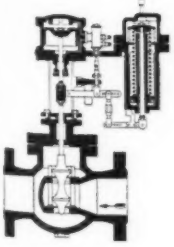
FLOWMATIC

NORTHERN EQUIPMENT COMPANY
281 GROVE DRIVE, ERIE, PA.
BRANCH PLANTS: Canada, England, France and Austria
Representatives Everywhere

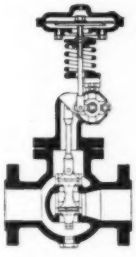




Type W-DBI. Weight loaded, direct-operated



Type 3-SH-2C for heavy duty. Relay-operated, self-contained



Type R-DBI for remote control from master

COPES

Headquarters for . . .

Boiler Feed Water Control . . . Excess or Constant Pressure Control, Steam or Water . . . Liquid Level Control . . . Balanced Valves . . . Desuperheaters . . . Boiler Steam Temperature Control . . . Hi-Low Water Alarms.

TECHNICAL BRIEFS

ENGINEERING DEVELOPMENTS HERE AND ABROAD DIGESTED FOR BUSY POWER MEN

GAS TURBINES

Dependence of Gas-Turbine Economy on Internal Aerodynamic Design, *by H Roxbee, A R Howell, A G Smith, National Gas Turbine Establishment, Ministry of Supply, England.* Compares physical and performance differences of gas-turbine plants for air craft and stationary applications from a general standpoint. Compressor efficiencies, Fig. 1, are increased by a larger number of stages at lower rotation speeds; turbine efficiencies behave in a similar manner. Stage efficiencies of both rotating elements are quite high, but the volutes, needed to conduct gas flow in and out of these components, cause an appreciable loss. This results in the component over-all efficiencies being markedly lower than the stage performance throughout the entire range of the operation.

These volute losses, together with friction losses in ducting and heat exchangers, may be summed up as pressure losses causing a lowered performance of the entire gas-turbine plant.

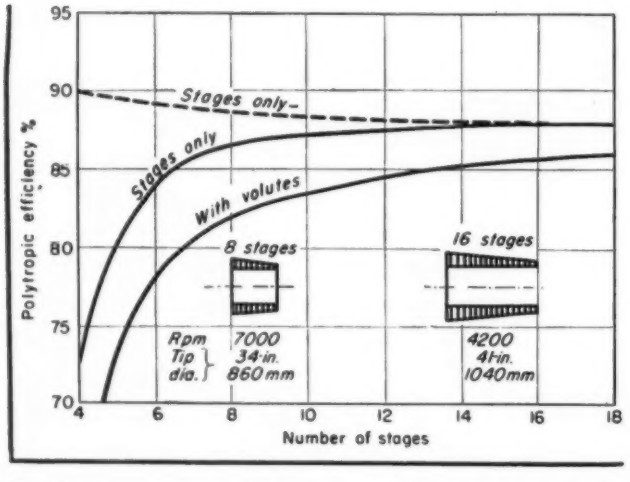
Aircraft plants operating at about 8000 rpm with a pressure ratio of 8.1 and a turbine inlet temperature of 800 C (no regenerator) have about the same thermal efficiency as a stationary plant operating at 4000 rpm, pressure ratio of 3.2, inlet temperature of 600 C, and a 70% efficient regenerator. *WPC, Paper No. 7, Sec. C2.*

The Gas Turbine as a Means of Securing Additional Output of Power, *by W Karrer, Ateliers de Construction Oerlikon, Switzerland.* By hooking up a gas turbine with a steam generator increased efficiency of power generation can be obtained. The principle is based on the simple fact that the heat exhausted by the gas-turbine plant can be used by and charged to the boiler instead of being discarded to atmosphere. An analogous situation exists with power generated by backpressure steam turbines, Fig. 2, where the exhaust steam can be charged to process heating.

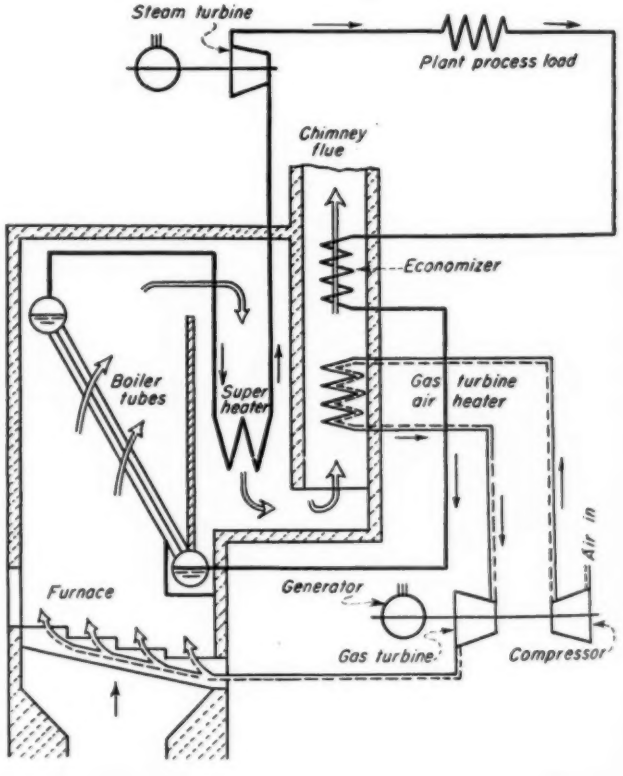
In the cycle analyzed here the gas turbine drives both its compressor and an electric generator. Atmospheric air enters the compressor and is discharged to an air heater in the boiler's gas path. The heated air then expands through the gas turbine and at atmospheric pressure enters the boiler furnace as combustion air.

The author shows that, for balanced conditions with a backpressure steam turbine, total power can be about doubled by adding a gas turbine to the plant circuit. Power produced by the gas-turbine set is obtained at thermal efficiencies from about 45 to 60%, markedly increasing the over-all plant performance. *WPC Paper 13, Sec C2.*

(*Continued on page* 130)



1 Axial-compressor efficiencies, for a given pressure ratio, increase (above) by using a larger number of stages at the lower rotation speeds. If volutes are used efficiency droops



2 Backpressure turbine in steam cycle exhausts its steam to process with a rise in power output. A proposed gas turbine in plant power cycle would supply heated air to the furnace

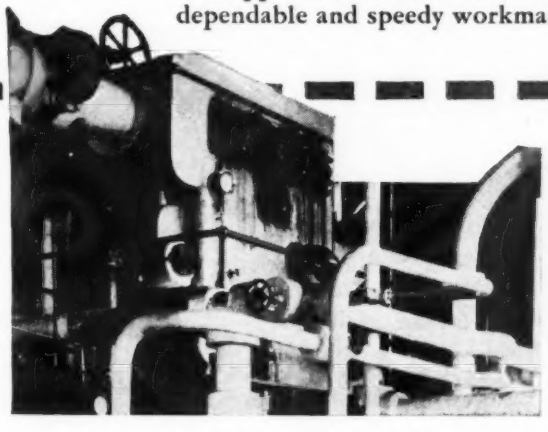
24 Years of Service
IN RAILROAD POWER PLANT

Another example proving...: the right insulation correctly applied, never grows old.

ENGINEERING: The first step in an insulation job that will give years of service, such as the Railroad installation described below, is to call in an experienced insulation engineer. Johns-Manville maintains a staff of insulation experts. Each man knows how to take the guesswork out of your job...make it "*right* the *first* time."

RIGHT INSULATION: Many types of insulations are necessary to meet varied service conditions. In the Johns-Manville Research Laboratory—largest of its kind in the world—new and more efficient insulations have been developed. J-M Insulation Specialists help you choose the *right* insulation for each temperature requirement—from minus 400° up to 2800° F.

CORRECT APPLICATION: No insulation is better than the man who installs it. J-M Insulation Application Units are industry's first choice for completely efficient jobs because (1) Each Unit is trained in all phases of insulation application; (2) Only skilled mechanics and up-to-date application methods are used. You get thorough, dependable and speedy workmanship.



24 YEARS YOUNG! Johns-Manville Insulations were installed in this power plant of the Missouri, Kansas, Texas Rail Road Company at Parsons, Kansas, back in 1923. Because this job was *engineered right* and *applied right,* it is still providing dependable insulation service. For help on your insulation problems, write Johns-Manville, Box 290, New York 16, N. Y.

JOHNS-MANVILLE JM PRODUCTS

JOHNS-MANVILLE *First in* INSULATIONS

Temperature Measurements and Combustion Efficiency in Combustors for Gas Turbine Engines, *by W T Olson, Everett Bernardo, National Advisory Committee for Aeronautics.* Investigations of general altitude performance of combustors for aircraft gas-turbine engines employed many thermocouples for average temperature, temperature-distribution readings and combustion efficiencies. Results indicate that values of combustion efficiencies based on temperature measurements give satisfactory approximations and show effect of primary variables on efficiency. Paper discusses thermocouples, their installation, construction and measurements for which they were used. *ASME Paper No. 47-A-23.*

Axial-Flow Compressors for Gas Turbines, *by A I Ponomareff, Westinghouse Elec Corp.* Operating principles, characteristics, types and performance factors of axial-flow compressors serve as the subject matter for this informative paper. The principal problem yet to be solved in making the gas turbine a competitor of highly developed steam turbines and reciprocating engines is, in the author's opinion, the design of an efficient compressor that can be manufactured at low cost. *ASME Paper No. 47-A-28.*

Gas-Turbine Plant Combustion-Chamber Efficiency, *by A L Landen, Stanford University.* A proposed set of standard definitions for efficiencies of combustion chamber performance is advanced. Three distinct terms are applied: (1) incomplete combustion and setting losses (2) flow friction and auxiliary-drive energy requirements (3) influence of these losses on over-all plant thermal efficiency and output. Arguments are developed for thermodynamic meaningfulness, ready adaptability for evaluating test performance and cycle analysis of the test terms. *ASME Paper No. 47-A-32.*

The Universal Optimum Power Cycle for Elastic Fluid Turbine Power Plants, *by John Keitner, ME, ScD and Frederick Nettel, ME, EE.* Investigations by the authors are used as the basis for a general theoretical heat cycle called a hexagon cycle of which the Brayton, Ericsson and Carnot cycles are special cases. The hexagon, they claim, lies between the Brayton and the Ericsson. The difference between it and the Ericsson is in restricting (1) intercooling to the first part of compression (2) reheating to the first part of expansion. Formulas are developed to determine the point between the Brayton and Ericsson cycles where efficiency is highest. *ASME Paper No. 42-A-43.*

Determination of Gas-Turbine Combustion-Chamber Efficiency by Chemical Means, *by Peter Lloyd, Ministry of Supply, National Gas Turbine Establishment, England.* A gravimetric technique of achieving a complete chemical determination of gas-turbine exhaust serves as the calibration base for combustion-chamber efficiency. The author feels that this technique possesses an accuracy far superior to the heat-balance one. It has the added merit of indicating nature of combustion loss, a very useful aid. Various approximate methods, chemical, physiochemical and physical can be devised for comparison against the exact, complete method. *ASME Paper No. 47-A-58.*

HOW TO OBTAIN COMPLETE TEXT

Material appearing in this month's briefs comes from one of these three sources:

World Power Conference at The Hague in Sept. Papers are identified by the initials *WPC* and the paper No. Supply is limited at the present but will be available in the future.

American Society of Mechanical Engineers, fall meeting, Salt Lake City, Utah. Sept. 1-4, 1947. Papers are identified by initials ASME and paper No. Available while supply lasts at American Society of Mechanical Engineers, 29 W 39th St, New York, N. Y.

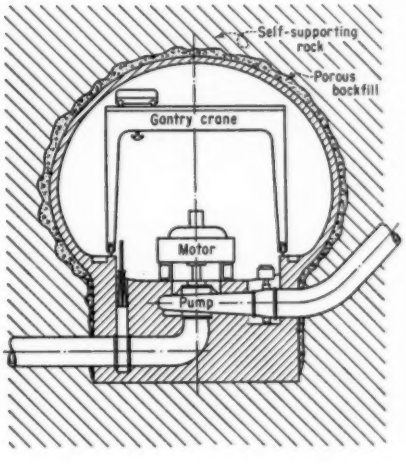
American Society of Mechanical Engineers, annual meeting, Atlantic City, N. J. Dec 1-5, 1947. Papers are identified by initials ASME and paper No. Available at same address, under same terms as above.

HYDRAULICS

Pumping Requirements for Irrigation in Columbia River Basin and Central Valley Projects of the Bureau of Reclamation, *by Irving L Wightman, U. S. Bureau of Reclamation.* An introduction to papers to be presented on the design of pumps for the Grand Coulee pumping plant on the Columbia River and the Tracy pumping plant of the Central Valley projects in California. This paper outlines the history, plan and facilities of each project and pumping requirements for irrigation. Each of the 12 Grand Coulee pumps will have a rated capacity of 1600 cfs at the low lift of 270 ft when Grand Coulee reservoir is at its highest level, and will be driven by a 65,000-hp synchronous motor. The Tracy pumping plant is being constructed near Tracy, Calif. It will have six 767-cfs vertical-shaft centrifugal pumps operating under 197-ft head, each driven by a 22,500-hp synchronous motor. *ASME Paper No. 47-A-116.*

Hydraulic Problems in Connection With the Design of the Granby Pumping Plant, *by Eliot B Moses, U. S. Bureau of Reclamation.* Granby pumping station, located over 8000 ft above sea level near Granby, Colo., will have three 200-cfs vertical-shaft centrifugal pumps, operating under 186-ft maximum head and driven by 6000-hp synchronous motors. Many unusual problems arose in the design of this plant, which delivers water across the Continental Divide in Colorado. Because of 94-ft variation in suction head the pumps are located 107 ft below ground level.

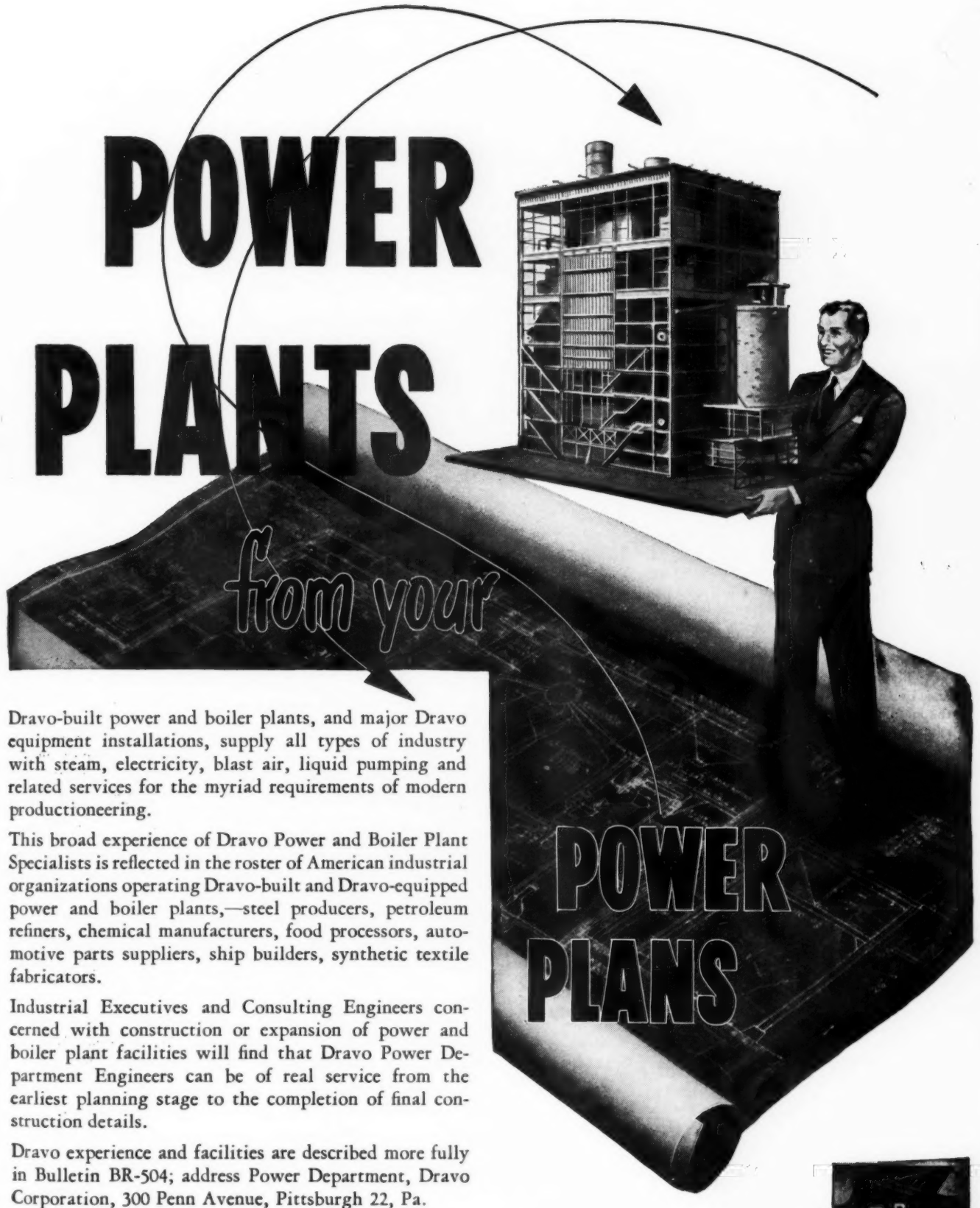
A design is analyzed for a subterranean plant with a cross section based on the hydrostatic arch, above. Such a shape results in a considerable saving in concrete but is suitable only if the exterior hydrostatic and earth loads are fairly constant. Because of limits to voltage fluctuation when starting the pump motors, on a comparatively small power system, several methods were studied of bringing the units up to synchronous speed.



Final design includes a discharge valve, closed when starting, and equipment for depressing the water below

(*Continued on page* 146)

POWER PLANTS



Dravo-built power and boiler plants, and major Dravo equipment installations, supply all types of industry with steam, electricity, blast air, liquid pumping and related services for the myriad requirements of modern productioneering.

This broad experience of Dravo Power and Boiler Plant Specialists is reflected in the roster of American industrial organizations operating Dravo-built and Dravo-equipped power and boiler plants,—steel producers, petroleum refiners, chemical manufacturers, food processors, automotive parts suppliers, ship builders, synthetic textile fabricators.

Industrial Executives and Consulting Engineers concerned with construction or expansion of power and boiler plant facilities will find that Dravo Power Department Engineers can be of real service from the earliest planning stage to the completion of final construction details.

Dravo experience and facilities are described more fully in Bulletin BR-504; address Power Department, Dravo Corporation, 300 Penn Avenue, Pittsburgh 22, Pa.

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Power and Boiler Plants — Pumping Stations — Power Plant and Contractors' Equipment — Direct-Fired Heaters — Industrial Heating and Ventilating — Bridge Substructures — Docks — Pump Houses and Intakes — Mill Foundations — Locks and Dams — Shafts, Slopes and Tunnels — Towboats and Barges — Coal and Ore Bridges — Cranes and Derrick Boats — Crane Cab Coolers — Open Steel Flooring — Concrete Aggregates — Inland River Transportation

POWER NEWS

BUSINESS ITEMS • APPOINTMENTS • FOREIGN FIELDS
WASHINGTON NOTES • NEW DEVELOPMENTS • CONVENTIONS

Tide Power Still Holds Interest in England

The Severn tide-power project is still being considered in England, but prospects do not look favorable for building it in the near future. One has been proposed, however, for installation in Menai Strait between Anglesey Island and Northwest Wales mainland. This project would have the advantage of continuous power generation, by providing storage in two reservoirs formed by three dams.

One of these dams would be built at northeast end of the strait near Bangor, a second dam would be built about halfway along the strait and third at its southwest end, at Belan Point. A power plant is to be installed at the center dam. Reservoir formed by the dam at Bangor will be kept at its highest possible level by filling it at high tide. At Belan Point the reservoir will be kept at its lowest possible level by emptying it at low tide.

At high tide, with Bangor reservoir full and Belan Point one empty, the plant at the middle dam is started. Level in Bangor reservoir drops and that in the other rises, until tide level drops below that in Belan Point reservoir. Gates in the dam forming this reservoir open and its level goes down with the tide. When tide level starts to rise Belan Point gates close and level in this reservoir starts to rise because of discharge from the turbines.

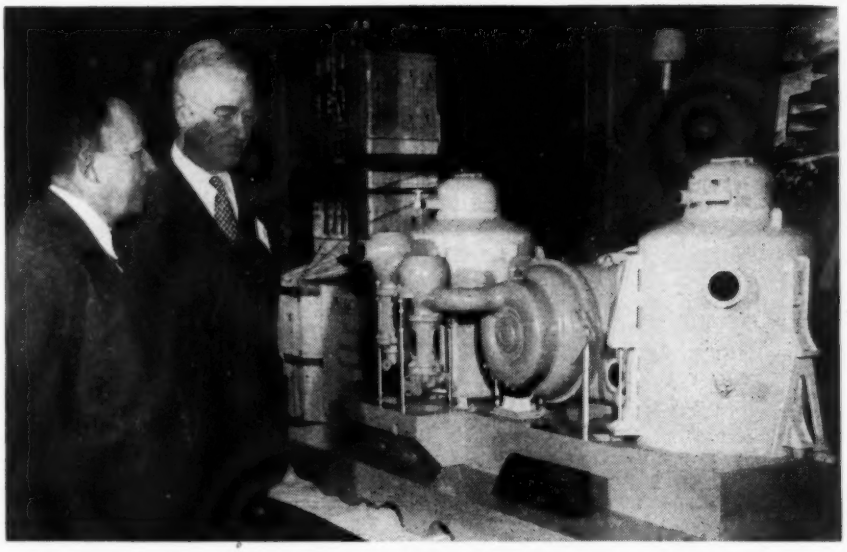
All this time level in Bangor reservoir is dropping. When tide level equals that in this reservoir, gates open and it fills with rising tide level. At high tide this reservoir is again full. During this cycle there is always a head difference between the two reservoirs to insure operation of the power-generating units. Average plant output is estimated at 8000 kw.

Britain Operates Second Atomic Pile in 1948

LONDON: High-power atomic-energy pile, to be constructed at atomic-energy research establishment at Harwell, near Didcot, Berkshire, is expected to be in operation about the middle of 1948, G R Strauss, Minister of Supply, told the House of Commons recently.

Britain's first atomic pile, a small-scale low-energy proposition, has been in operation at Harwell since late this summer. It is producing "about enough heat to run one electric fire," Professor P B Moon, secretary of the Atomic Scientists' Assn,

(*Continued on page* 170)



Scale Model of New 7500-Kw Mercury Turbine

A R Schiller (left), president, Public Service Co of New Hampshire, and T S Knight, General Electric commercial vice-president, view a scale model of new GE 7500-kw mercury turbine. Two of these units are being furnished for the 40,000-kw Public Service station at Portsmouth, N. H., expected to be one of the most efficient in the world. Each of the two complete mercury elements consists of a mercury boiler, a 7500-kw 1200-rpm turbine-generator and a condenser boiler. Steam output of each condenser boiler is passed through a superheater element in the combustion space of the mercury boiler. Steam flows are then combined at 600 psi, 825 F, to feed a 25,000-kw 3600-rpm steam turbine direct-connected to a hydrogen-cooled generator. This model was exhibited recently at 23rd annual New England Conference at Boston

COMING EVENTS

Feb 2–6—American Society of Heating and Ventilating Engineers, 8th International Heating and Ventilating Exposition, Grand Central Place, New York 17, N. Y. Charles F Roth, manager, International Exposition Co, Grand Central Place, New York 17.

Feb 19–20—Prime Movers Committee, Pennsylvania Electric Assn, mid-winter meeting, Alexander Hotel, Hagerstown, Md. R L Hallman, Pennsylvania Power & Light Co, Hazleton, Pennsylvania.

Mar 1–4—American Society of Mechanical Engineers, spring meeting, St. Charles Hotel, New Orleans, La. Ernest Hartford, executive assistant secretary, 29 W 39th St, New York.

Mar 9–11—Western Pa. Safety Engrg Conference & Exhibit, Hotel William Penn, Pittsburgh, Pa. Harry H Brainerd, executive manager, Chamber of Commerce Building, Pittsburgh 19, Pennsylvania.

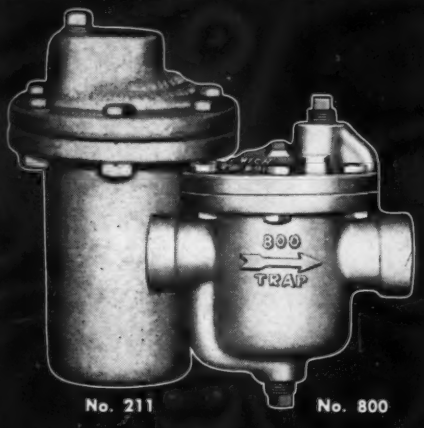
Apr 1–3—American Institute of Electrical Engineers, Great Lakes district meeting, Des Moines, Iowa. H H Henline, secretary, 33 W 39th St, New York 18, N. Y.

Apr 3–11—New England Electrical Show, Mechanics Bldg, Boston, Mass. Campbell-Fairbanks Exposition, Inc, 929 Park Sq Bldg, Boston, Mass.

Apr 5–8—National Assn of Corrosion Engineers, Hotel Jefferson, St. Louis, Mo. A B Campbell, executive secretary, 905 Southern Standard Bldg, Houston 2, Tex.

Apr 5–8—National Oil Heat Exposition, Chicago Coliseum, Chicago, Ill. C F Curtin, secretary-treasurer, Room 1837, 30 Rockefeller Pl, New York 20, New York.

Apr 28–30—American Institute of Electrical Engineers, Northeastern district meeting, New Haven, Conn. H H Henline, secretary, 33 W 39th St, New York 18, N. Y.



No. 211 No. 800

Above left — Armstrong bottom inlet—top outlet series trap.

Above right — Armstrong No. 800 side inlet—side outlet trap.

PROOF THAT ARMSTRONG TRAPS PAY DIVIDENDS:

NO MAINTENANCE IN 3 YEARS OF SERVICE FOR 20 traps installed on press, tumblers, steam boards, iron sets and steam plants.—*Gran Tintoreria Ritz, Mexico.*

•

COOKING TIME CUT 25% with use of Armstrong traps on steam kettles and vats. One trap on a steam coil has given dependable service for 18 years.—*Kerber Packing Co., Elgin, Ill.*

•

80% MAINTENANCE REDUCTION and 20% FUEL SAVINGS with use of Armstrong traps.—*Eastern Box Co., Baltimore, Md.*

•

UNIFORM TEMPERATURE of greenhouse and maintenance reduction after installation of Armstrong traps.—*Zeidler Floral Company, Evansville, Indiana.*

For Fuel Savings and Maximum Production

INSTALL AN INDIVIDUAL ARMSTRONG STEAM TRAP ON EACH UNIT

WHY UNIT TRAPPING IS ESSENTIAL: If you try to drain condensate from more than one steam-consuming unit with the same trap, sluggish heating and low temperatures will almost always result. This is because no two units condense steam at the same rate. The pressure will be lowest in the unit condensing steam the fastest. Condensate from the higher pressure unit will back up into the lower pressure unit (or close the check valve), temporarily blocking off its drainage. This prevents escape of air and condensate, lowers the machine temperature and wastes fuel. However, the use of a separate trap on each unit permits individual operation without any effect from different condensing rates. You get maximum temperatures and maximum production.

WHY *ARMSTRONGS* ARE BEST FOR UNIT TRAPPING: They not only discharge condensate as fast as it accumulates, but they discharge air as well. This is essential to fast heating and uniform high temperatures. Furthermore, you don't have to be afraid of increasing the number of traps in your plant because Armstrongs seldom need attention. They won't clog or stick; dirt is swirled right through; the chrome steel valve and seat and corrosion-resistant stainless interior stand up in constant service for years and years.

THE ARMSTRONG STEAM TRAP BOOK gives complete data necessary for selection, installation and maintenance of Armstrong traps. Send for a copy.

ARMSTRONG MACHINE WORKS
812 Maple Street • Three Rivers, Michigan

ARMSTRONG *Inverted Bucket* STEAM TRAPS

No. 3 of a series of advertisements devoted to improving efficiency through better trapping.

A Resolve for 1948

A contemporary, the magazine *Industrial Marketing*, in discussing the subject of advertising directed to the power field, has defined a subject of great significance to every power engineer:

"Maximum power use per worker is the sure path to low-cost production. Take one classic example—the big Chicago machine tool show a few months ago. The mammoth Dodge-Chicago plant was alive with monsters for us bipeds to operate . . . with more horsepower at man's fingertips than ever in industrial history.

"Take the modern lathe. Today it utilizes at least ten times as much power as its predecessor of 1900—with ten times as much production.

"Let's concentrate now on *power* as a commodity, an almost priceless product in today's economy. The fate of the world hangs on America's ability to produce. That means using *more* power *more* effectively.

"Surely, from here in, we can count on the power engineers of this country to squeeze the last drop of efficiency out of existing equipment . . . of even more mothering maintenance of installations . . . and a more hard-boiled attitude on obsolescence and the selection of new equipment."

Another reason for using the greatest care in purchasing new equipment is that the new pump or the new valve you buy tomorrow may cost more than today's units. This imposes the obligation of getting the best buy you can right now, by vigilant comparison of values and inspection of advertised performances.

Certainly, the continued progress of our American economy depends on the performance of every power man in making and using more power. And that means a review today of your power facilities. A survey by your own staff—or by an outside consultant—will provide you with the facts to guide you in your recommendations for new equipment, better maintenance, more efficient operation.

Here is a good resolution for 1948: Make a careful study of your entire power operation, in order to determine the best ways of generating and applying *more* power, *more* effectively.

George Edwards
Engineer

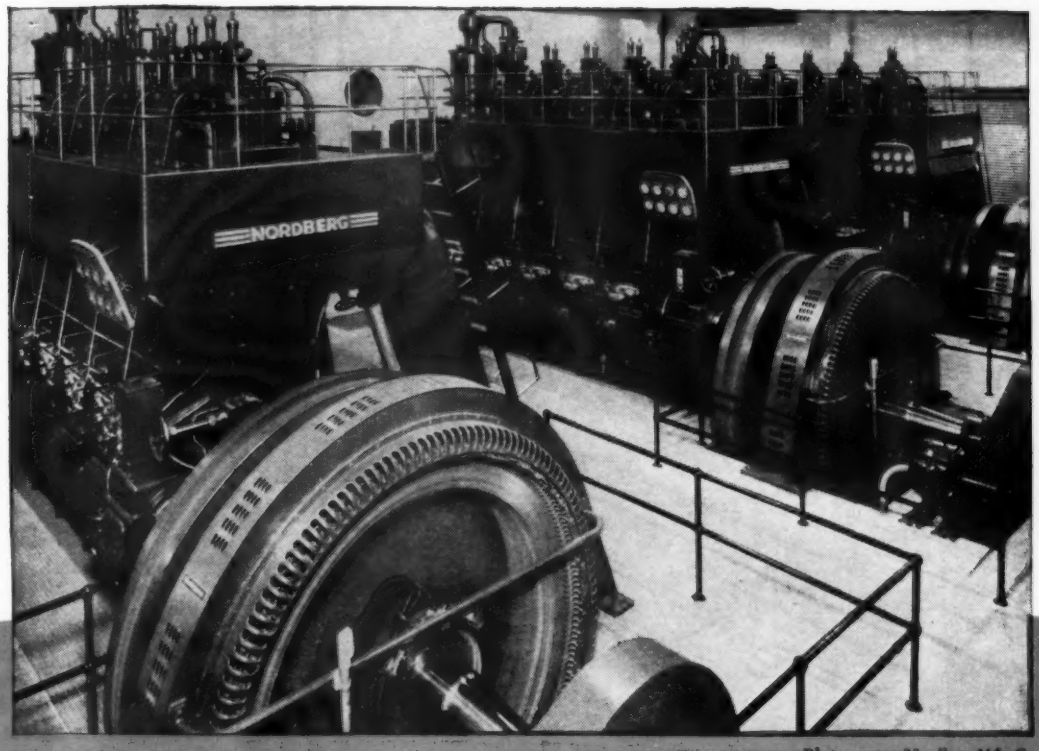


Photo courtesy Nordberg Mfg. Co.

ASSURE LOW COST POWER

Texaco Ursa Oils keep rings free for high efficiency, low fuel costs

When your Diesels are lubricated with *Texaco Ursa Oils,* you can count on—

1. *Low fuel bills* because *Ursa Oils* keep rings free for proper seal . . . avoid wasteful blow-by. You get full power from your fuel and burn less of it.
2. *Low maintenance bills* because *Ursa Oils* assure freedom from sludge, varnish and carbon formations . . . prevent bearing corrosion . . . minimize wear. Your engines run longer between overhauls . . . parts replacements are fewer.

Texaco Ursa Oils are approved by all leading Diesel manufacturers and you can get them for every type, size and speed of engine. They are America's most famous Diesel lubricants, as shown by the fact that—

More stationary Diesel horsepower and more Diesel locomotives in the U. S. are lubricated with Texaco Ursa Oils than with any other brand.

Let a Texaco Lubrication Engineer help you run your Diesels more efficiently and economically. Just call the nearest of the more than 2500 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

FREE: "Diesel Operation" book—112 pages of valuable information. Explains simply and clearly the relation of fuel and lubricants to operating efficiency of Diesel engines. Write for your copy today.

TEXACO

TEXACO Ursa Oils

FOR ALL DIESEL ENGINES

TUNE IN . . . TEXACO STAR THEATRE presents the TONY MARTIN SHOW every Wednesday night. • METROPOLITAN OPERA broadcasts every Saturday afternoon.

When you're faced with shortages, need equipment parts, or must ship finished products to meet contract dates — use the speed and handiness of Air Express and your worries are over. Air Express is the fastest possible way to ship or receive; cuts days off shipping time.

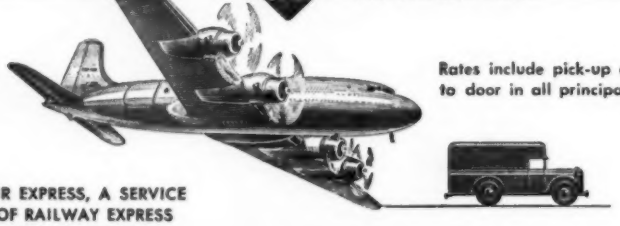
Air Express goes on all flights of the Scheduled Airlines — with air speeds up to 5 miles a minute. Special door-to-door service (no extra cost!) speeds up your shipments still more. Use the speed of Air Express regularly. Rates are surprisingly low.

Specify Air Express - World's Fastest Shipping Service

- Low rates — special pick-up and delivery in principal U. S. towns and cities at no extra cost.
- Moves on all flights of all Scheduled Airlines.
- Air-rail between 22,000 off-airline offices.
- Direct air service to and from scores of foreign countries.

True case history: Machine parts made in Camden were needed in Chicago. 32-lb. package picked up 11 A.M. the 28th, delivered 5 P.M. same day. 669 miles, Air Express charge only $6.88. Gave days more time to complete the job. Other weights, any distance, similarly inexpensive and *fast*. Just phone your local Air Express Division, Railway Express Agency, for fast shipping action.

AIR EXPRESS
GETS THERE FIRST



Rates include pick-up and delivery door to door in all principal towns and cities

AIR EXPRESS, A SERVICE OF RAILWAY EXPRESS AGENCY AND THE

SCHEDULED AIRLINES OF THE U.S.

Plant Problems

(*Continued from page* 116)

One Tower Doesn't Take More Air

HB WILL NOTICE that the specification performance data under various conditions, and the effectiveness depend largely upon the proper location. Nevertheless, the f-d tower neither takes nor requires 72% more air and 30% more hp than the i-d. Instead, the f-d cooling tower is capable of delivering that much air at only slightly more hp than the i-d tower.

Apparently, *HB* is primarily concerned about economical operation of the cooling towers. From his past operating experience he must have observed that no two days of operation are alike. Running cooling towers economically requires study and alertness on the part of operators, and not merely button pushing. Unfortunately, I am unable to offer definite suggestions as to most economical tower operation, because *HB* did not include details as to operating sequence.

Cooling towers reduce temperature by evaporation. Therefore, any temperature reduction accomplished is limited by the wet-bulb temperature of the air that is used to produce the evaporation. Theoretically a properly designed cooling tower should be able to cool water to wet-bulb temperature. Actually, however, it is not economical to cool closer than 3 F to the wet-bulb temperature, and attempts to approach it may be expensive. **Carl Bachmann, Astoria, L. I.**

Different Designs Give Variable Results

DIFFERENCES OF EFFICIENCY between the towers are due to design conditions. The efficiency of an i-d cooling tower is usually higher than the same sized f-d tower. In addition, there is often a difference in two i-d cooling towers of equal capacity if they are made by different manufacturers.

The difference in ratings is not an accurate indication of efficiency. For example, the 15-hp motors may be operating at 90% of load. Also, one tower may be cooling more water or lowering the temperature more than the other. The information needed to make an accurate comparison between the two towers is volts, amperes, phase and power factor of each motor, also,

with CHAPMAN STEEL VALVES you get HIGH PRECISION and LONG LIFE

Chapman Steel Valves are precision-made. Although manufactured with production-line speed and economy, they actually have the precision rating of custom-made valves—*equalling* or *exceeding* standard specifications. They are made with metals which are developed and produced in Chapman's own foundries under strict metallurgical control, thus insuring high performance and long life.

Chapman Steel Valves are designed for pressures up to 1500 pounds per square inch . . . for temperatures up to 1000° F., or even higher, and as low as −160° F.

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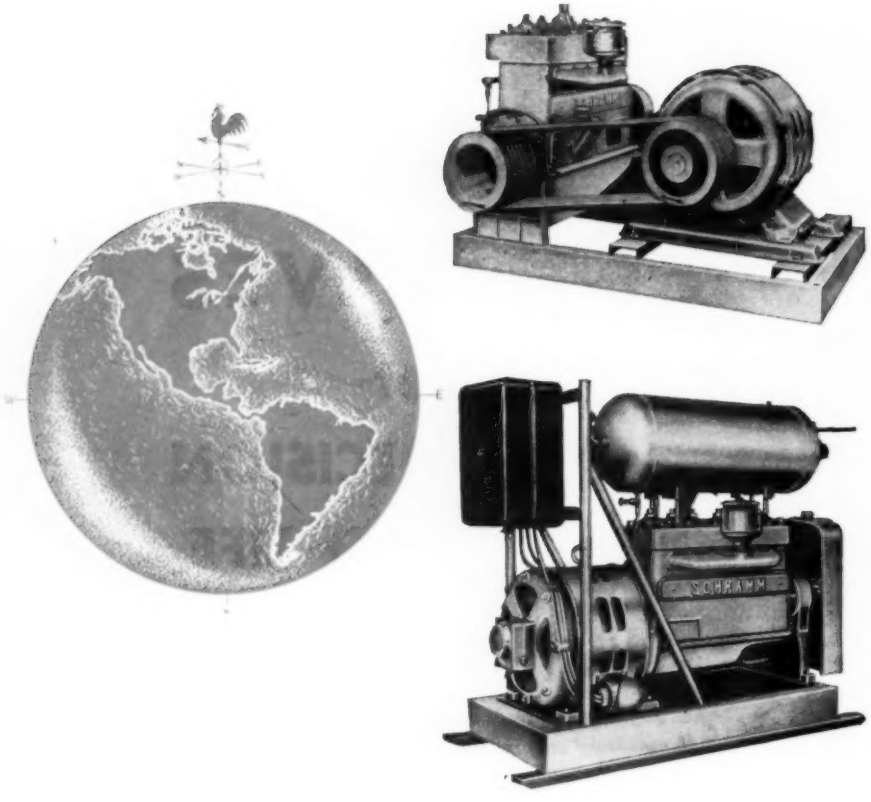

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At almost every turn you need compressed air!

The check list (at right) indicates some of the many compressed air jobs to be done, all of which are accomplished easily, quickly and economically with Schramm Air Compressors.

Here's *why* you profit, as others have, by using Schramm: they're compact, lightweight, easy to start; built for rugged jobs, to provide a continuous flow of air.

Important features include 100% water cooled; mechanical intake valve; forced feed lubrication and easy, electric push-button starting.

Performance everywhere has proved Schramm Air Compressors can do any compressed air job you require. Write today for list of models and sizes.

- Operating Pneumatic Hammers and Drills
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- Spraying Metal
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- Operating Precision Measuring Devices

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amount of water in tower and temperature in and out.

I am sure if these data are secured and compared, the difference in efficiency between the two towers would not seem so great. **Arthur J Wenig, Brooklyn, N. Y.**

Forced-Draft Tower Recirculates Air

HB WANTS TO KNOW why his f-d tower uses more air and hp than the i-d unit. Since both towers have the same capacity and cooling range it points to the fact that the f-d tower takes more air because it doesn't have evaporative efficiency equal to that of the i-d tower. This is due mainly to faults inherent in design. F-d towers often have from 7 to 20% evaporative cooling losses. This is due to recirculation of hot discharged air caused by strong fan suction, depending on fan locations, prevailing winds and surrounding buildings.

High-velocity draft tends to cause air turbulence. Also, initial strong air currents leaving the f-d fan make poor air-water mixing, thus reducing evaporative cooling efficiency of the tower. These faults are eliminated in the i-d tower as large volumes of air enter a large area of inlet louvers. The low velocity gives a better air-water mixture and a greatly increased evaporative cooling efficiency. Recirculation of hot discharged air and air turbulence are also eliminated in the i-d tower. **Arthur Belton, Montreal, Que.**

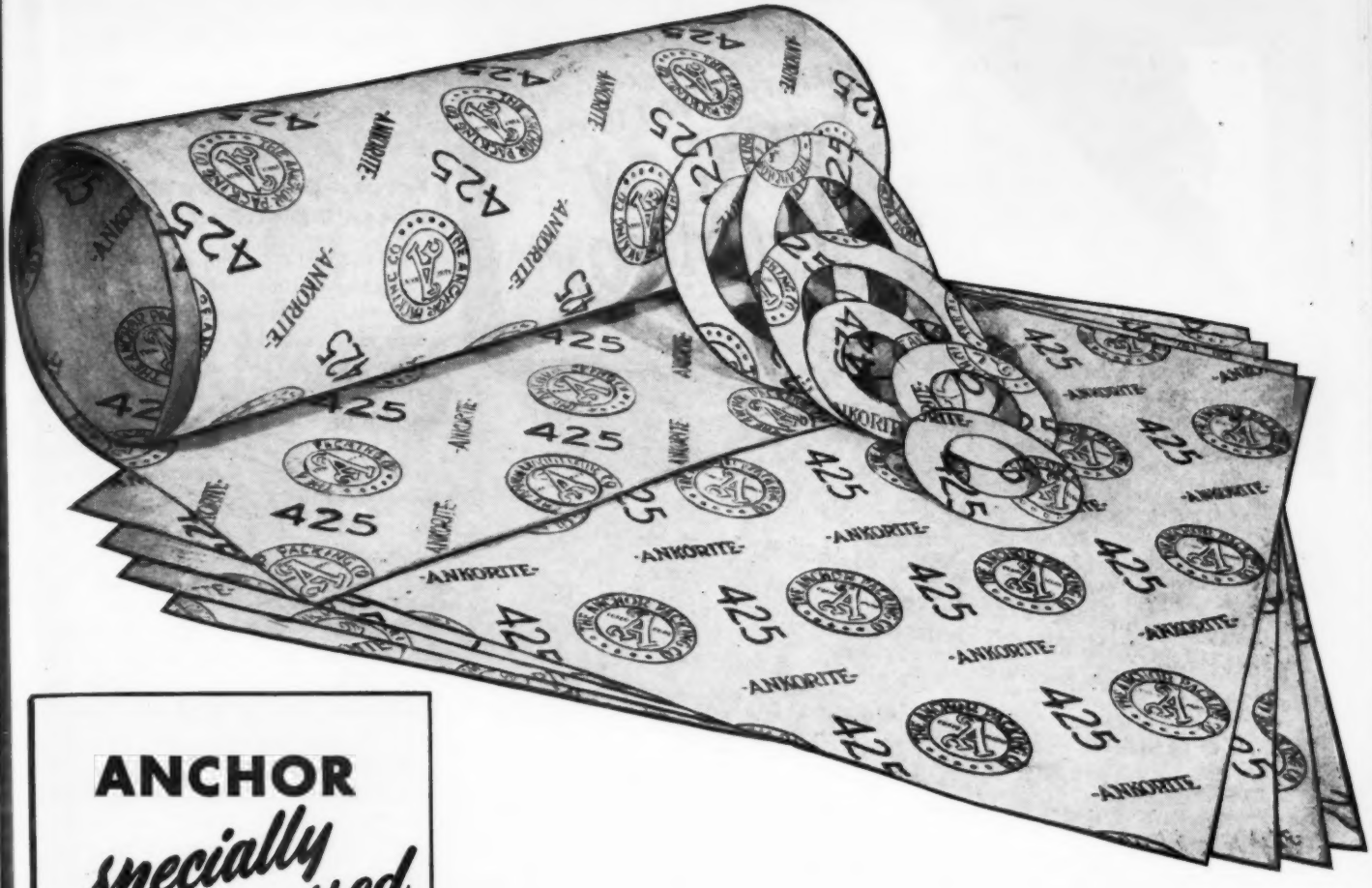
Induced-Draft Tower May Be Newer Design

ONLY THE NOMINAL RATING of *HB's* two cooling towers is given. He gives no information on actual performance of each. It is possible that the f-d tower is capable of carrying a greater cooling load, which might account for its being equipped with a greater fan horsepower. Test data from the maker, if available, would be a basis for comparison.

By using a generally acceptable factor of 0.041 hp per sq ft of tower area he can just about get the installed fan capacity of each tower, as stated in the question.

Difference in tower area and fan hp may be due to the fact that the trend is, and has been for some time, toward i-d towers, which have constantly improved. For that reason it is likely that the i-d fan tower is of more recent design and more efficient.

In my opinion, only a survey of



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A cream colored compressed asbestos sheet manufactured with great care from long fiber Canadian asbestos. Through a special process, a refined mineral pigment with high heat and age resisting qualities is combined with the asbestos fiber and "felted" into laminated form under heavy pressure, to produce the finished sheet. This sheet is homogeneous and may be depended upon for high pressures and temperatures.

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BY "heat" we mean anything to 1600°F., for steel-industry use on all types of furnaces and stacks has proved THUR-MA-LOX Number 7 surfacing effective over that range of metal temperature.

Yet THUR-MA-LOX, unlike many heat-resistant coatings, protects at low temperatures, too, just as it does at high.

For instance, a THUR-MA-LOX-coated stack may be taken out of service at red heat and allowed to cool in sub-zero winter cold with no effect whatever on its corrosion-resistant qualities. Or it may be allowed to stand for an indefinite time after coating before being subjected to high heat, or even to any temperature above atmospheric.

The reason is that the protecting pigments of THUR-MA-LOX are sealed to metal not by one vehicle, but by two. The first is effective at low temperatures before high heat; the second takes over for upper-bracket readings and stays on the job for any subsequent dips to lower temperatures.

Together they make a good team — one you can really count on for the type of application where everything else has failed.

THUR-MA-LOX Number 7 is black—weather-resistant—effective to 1600°F. Its companion coating, THUR-MA-LOX Number 10 Aluminum will give you the same long-lasting protection in sheltered locations to 1200°F.

DAMPNEY maintenance for metal

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operating conditions and actual performance can determine with any degree of accuracy the reason for the differences he mentions. **Henry H Demling, Bronx, N. Y.**

Forced-Draft Tower Doesn't Distribute Air

TWO PRINCIPLES of engineering govern the demand of more air and power by a f-d cooling tower over an i-d unit of the same size, to cool the same quantity of water through the same temperature range. The first is the over-all difference in pressure within the two towers. Water sprayed into a space at 29 in. Hg evaporates more rapidly and, therefore, releases more heat than water sprayed into a space under 30 in. Hg. The difference given in the problem is 1 in.

Second important factor is the distribution of air. Air discharged from a f-d fan tends to move along the shortest way out of the tower, and thus builds up areas of low velocity in other parts. If the louvers are open all the way around the base of an i-d tower, distribution of air flow and evaporation of water is nearly uniform in all unit areas of any cross section of the tower.

A check by anemometer, with water off, will show air flow in the f-d tower. It is possible that much can be done by baffle placement to eliminate short paths and distribute air more evenly through the tower. **George Holman. Marissa, Illinois.**

Pump Q & A

(*Continued from page* 108)

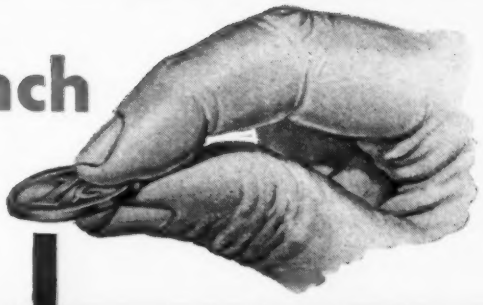
Q 8—How does submergence affect pump operation?

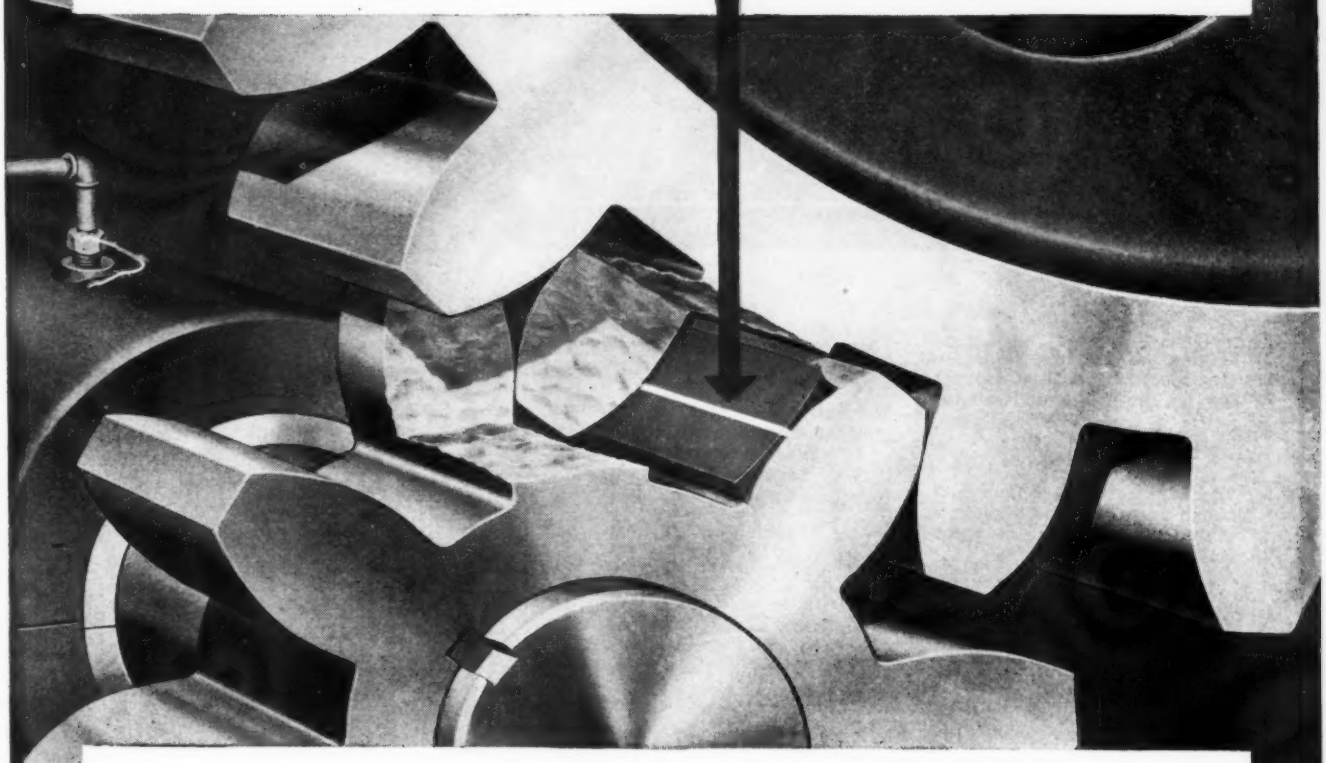
A—Submergence required for satisfactory operation is determined by pump-impeller characteristics. Pump speed, water velocity and temperature must be taken into consideration when determining the amount of submergence required. Special liquid characteristics, such as viscosities, or the degree of aeration, as in cooling-tower service, Fig. 4, influence a manufacturer's recommendations. Where low water levels must be maintained, allowing very little submergence, low-velocity first-stage impellers are often used.

Q 9—Can these pumps be used to handle volatile liquids?

A—Yes, many of these units are used for pumping gasoline, pentane, propane, and similar petroleum liquids.

No Place to Pinch a Penny...





The right oil here saves far more than it costs!

You're looking at a danger spot in industry—the spot where two gear teeth come together. That white line shows the contact area where pressures build up, sometimes to thousands of pounds per square inch.

This is no place to pinch pennies on lubrication. The right oil or grease here resists high pressures, protects gears against metal-to-metal contact and failure. The cost is negligible, compared to the many benefits obtained.

Socony-Vacuum brings 82 years' lubrication experience into your plant to help solve your gear problems.

Our Correct Lubrication program assures maximum protection for every type of gear—and all other vital machine parts. Get this program for less "toothaches" and headaches on production.

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Hotwell pumps of this type are often used for condensate service in steam power plants, Fig. 2. Where liquids are near the boiling point, low-velocity first-stage impellers are provided to prevent flashing at the suction inlet before pump pressure is developed.

Q 10—What information does the manufacturer need to select a vertical turbine pump?

A—Capacity (and variation, if any), liquid to be pumped, well diameter or sump data, water level when pumping, pump setting or over-all length, total head, discharge location, type and characteristics of drive should all be submitted. It's better to provide too much information than to furnish insufficient data which might result in improper pump application.

Q 11—How do capacity requirements influence selection of a vertical turbine pump?

A—For nearly constant capacity, select a pump to operate as closely as possible to its peak efficiency. Capacity requirements can vary, as in municipal water systems having peak loads in daytime, or in an industrial plant requiring more water in summer for cooling purposes. Complete information on possible capacity variations permits the manufacturer to recommend a pump with a capacity curve best suited to the expected operating conditions.

Q 12—What information should be given on the liquid to be pumped?

A—Any liquid other than clear cold water requires complete data, including, if possible, water analysis. River waters, mine waters, or sea water may require special material in the pump's construction if best service is to be obtained. Previous experience with material used in pumping the water is valuable information for a manufacturer. Also note high temperatures, vapor pressure, high aeration, or presence of gases in the liquid if they exist, because they influence pump selection and help determine submergence recommendations. Viscosity and specific gravity are important to proper pump selection because they affect bowl assembly, shafting and driver capacity.

Q 13—What constitutes total head on a vertical turbine pump?

A—On open-suction pumps total head is total lift in feet from discharge center line to the surface of the liquid pool when pumping required capacity, plus the discharge pressure in feet at the discharge center line.

On closed-suction pumps total head is the sum of the pressure in feet at discharge center line, plus distance in

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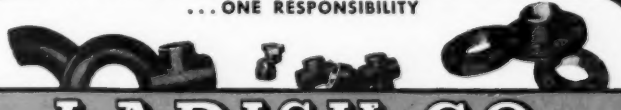

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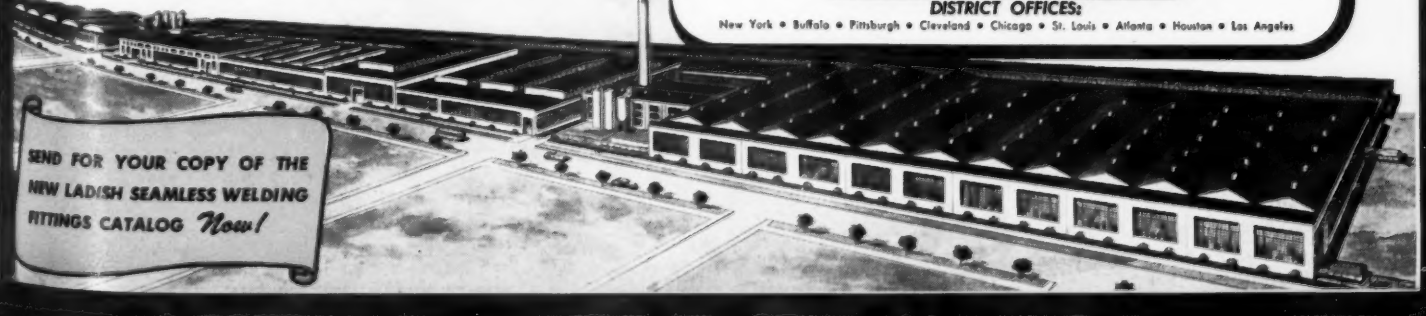

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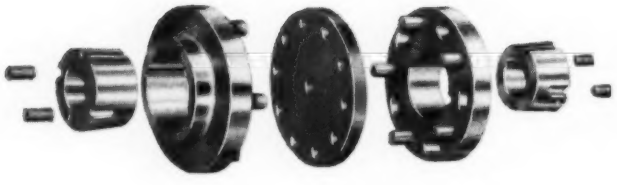

- ✔ Built with the famous TAPER-LOCK bushing (patented).
- ✔ Available from stock in a wide range of standard bores. *No reboring!*
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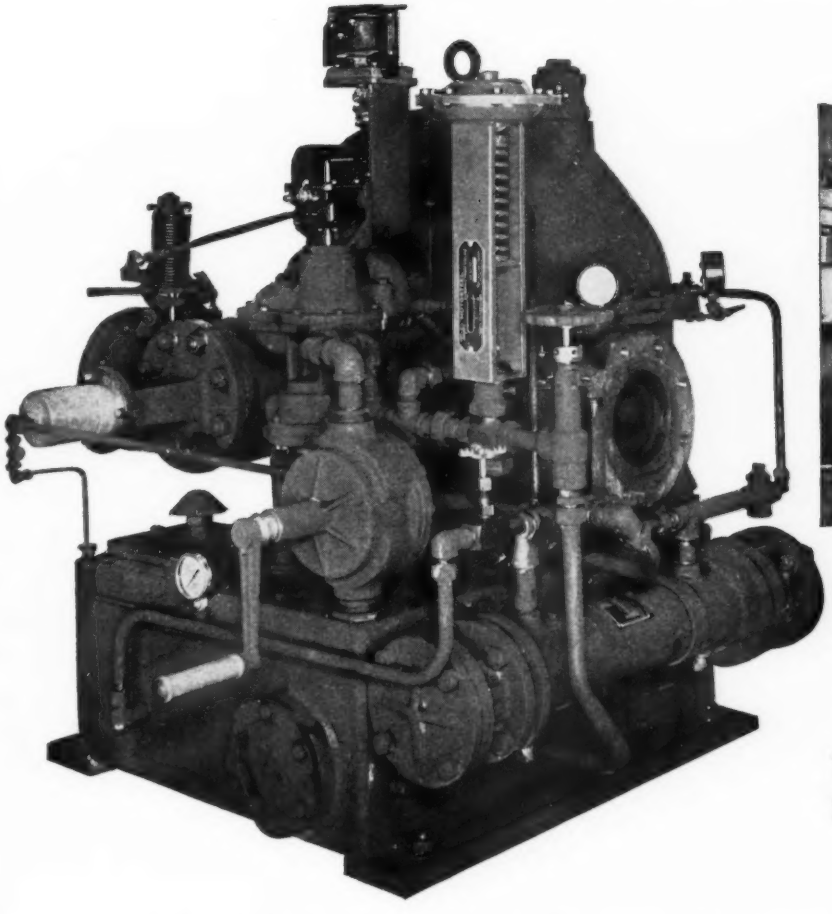

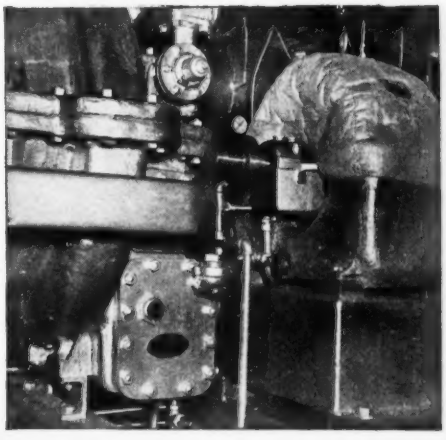

ON THE S. S. DEL NORTE

THIS 170 HP TERRY TURBINE DRIVES THE AIR CONDITIONING COMPRESSOR

This 170 HP Terry Turbine was specially designed to meet the requirements of efficient and dependable air conditioning power aboard ship.

It is equipped with a Variable Speed Governor, Overspeed Trip, Forced Feed Lubrication, and the various other accessories essential in shipboard installations of this type.

The experience of The Terry Steam Turbine Company in supplying turbines for driving air conditioning equipment covers almost 20 years and includes hundreds of land installations and many marine jobs. If you have a problem involving shipboard air conditioning power a Terry representative will be pleased to make recommendations.

Above Left: Shop view of turbine for the S.S. Del Norte.
Above Right: Installation view of the same machine direct connected to centrifugal refrigeration compressor.

T-1168

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WHEN

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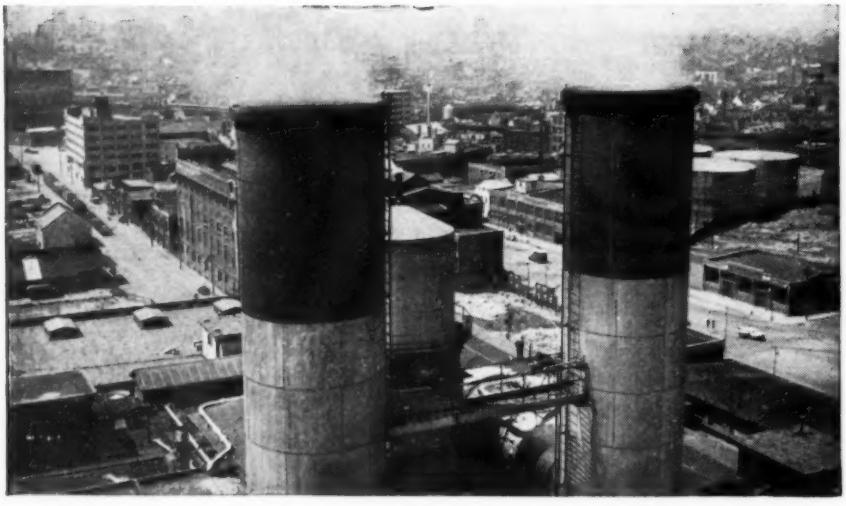

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feet from the center line of discharge to a gage located directly below the suction case, minus the pressure reading of this gage in feet.

Total dynamic head is total head, plus losses due to friction in the pump column and shaft assembly.

Q 14—Of what importance is water level when pumping?

A—Besides entering into total-head calculations, this level helps to establish setting of a well pump. When combined with sump or pit information, it helps determine the submergence characteristics required of a sump pump and, also, over-all length characteristics.

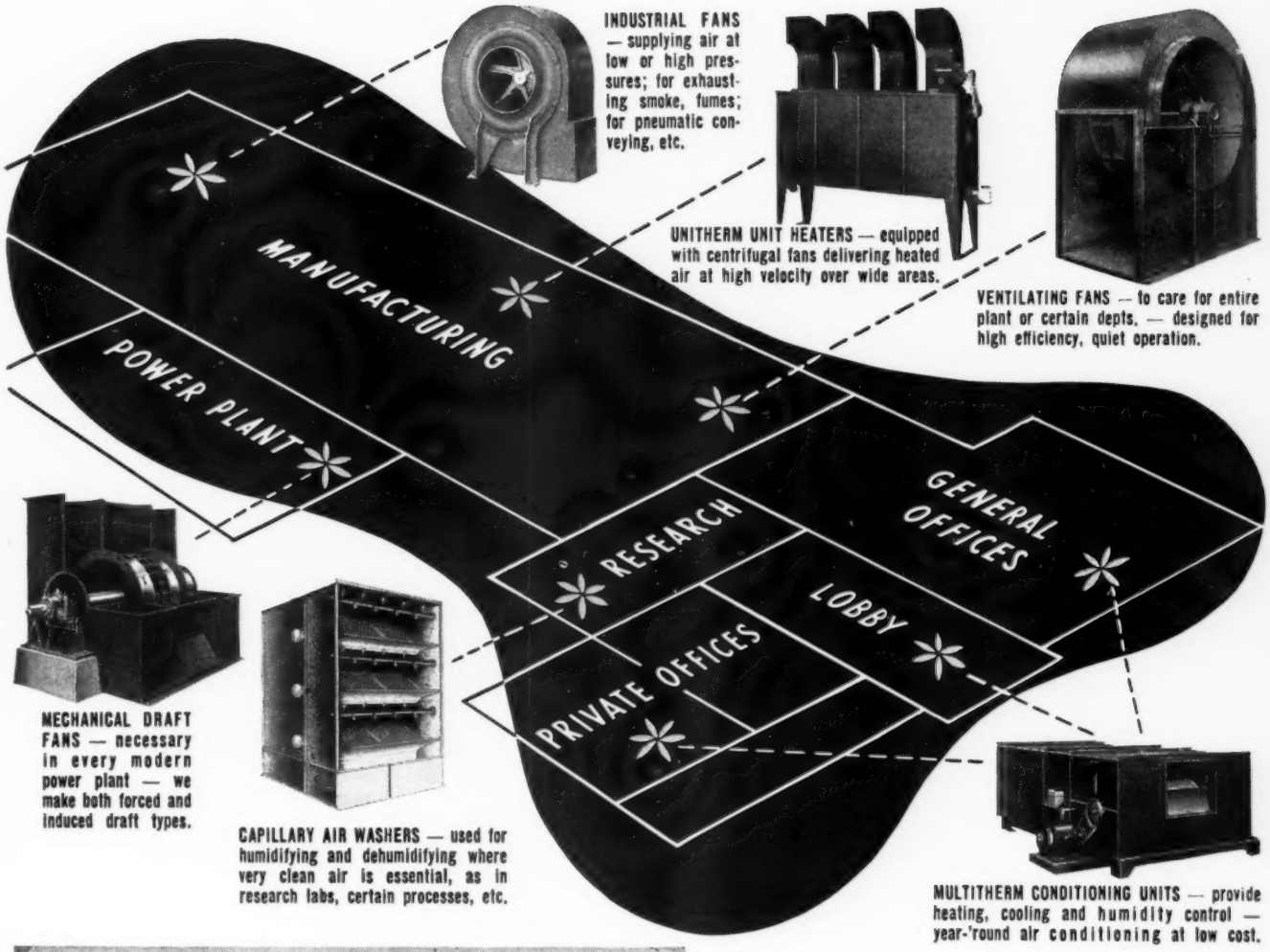
In well pumps, pumping level may vary seasonably because of groundwater conditions, so data concerning the variation between normal and lowest pumping levels should be taken into consideration. This variation is also possible in sump applications with a pump handling sea water where water level varies because of the rise and fall of tides.

Technical Briefs

(*Continued from page* 130)

the runner when starting at reduced voltage or when using the motors as synchronous condensers, a surge tank and a siphon, the latter at the upstream end of the discharge conduit. An air vent at top of the siphon stops reverse flow, and an automatic vacuum pump removes the air. *ASME Paper No. 47-A-93.*

The Hydrodynamics Laboratory of the California Institute of Technology, *by Robert T Knapp, Joseph Levy, J Pat O'Neill and F Barton Brown, California Institute of Technology.* Comprehensive description of the laboratory and its principal pieces of equipment that have been developed during the last five years. The primary object of the laboratory is to study characteristics of bodies moving in a fluid. Some of the problems that have been and are being investigated include: (1) force system acting on a moving submerged body (2) mechanism of cavitation from conditions of incipient cavitation to a point where the bubbles may envelop the entire body (3) effects of shape on cavitation production and development of cavitation-resistant shapes (4) forces acting on bodies passing through the interface between gas and liquid (5) nonsymmetrical forces acting on sub-



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Also it should save time in your engineering and purchasing departments, if they deal with but *one source of supply*.

Think it over! If the idea appeals, call in the Clarage application engineer in your city — or write us at Kalamazoo.

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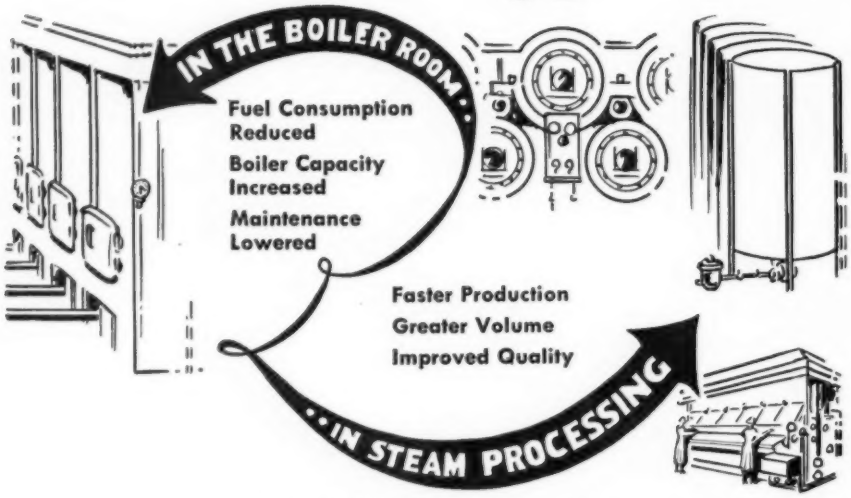
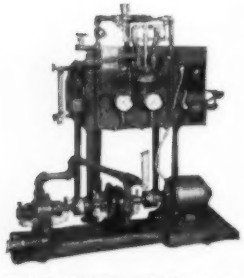
MAKE Steam GENERATION More Economical AND ITS USE More Effective





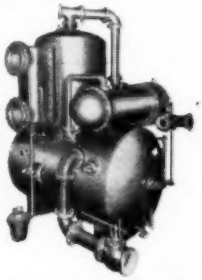
With Stickle Differential Drainage and Boiler Return System, condensate from steam traps draining processing units is discharged into Receiver Tank from which it is pumped to boilers, under pressure. (Receiver Tank and Pumping Unit shown above). A constant differential pressure between steam supply and return lines is automatically maintained regardless of fluctuation in boilers or supply pressure to units. In addition to saving BTUs in condensate, pumping costs are reduced, and purity of boiler supply and elimination of high velocities is reflected in lower maintenance for boilers, steam lines, and equipment.

Many industries using steam for industrial processing are cutting fuel consumption 15 per cent, or more, with Stickle Differential Drainage and Boiler Return Systems. These systems return condensate—representing 85 per cent, or more of boiler supply—from processing units to boilers at temperatures only slightly lower than steam at operating pressures, eliminate flash steam waste, and effect other economies.

Higher temperatures of boiler supply increase boiler capacities, make drier steam, and assure higher and more uniform pressures. Combined with positive drainage of condensate, these advantages result in higher operating efficiency for processing units.

Results for specific conditions of operation are predetermined and guaranteed. Additional information and data mailed on request.

Positive and complete drainage of steam condensing spaces permits high operating efficiency of processing units. Steam is dry and supplied at higher and more uniform pressures.



Necessary make-up water is supplied to boilers by Stickle Open Coil Heaters, depleted of scale-forming substances and with non-condensable gases eliminated, at temperature of saturated steam in heaters. One-sixth of make-up is pure distilled water—steam condensed in the heating and purifying process.

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Successfully Serving for More than 40 Years Paper Mills, Food Processors, Textile and Hosiery Mills, Laundries and Other Manufacturers Using Steam for Industrial Processing

STICKLE EQUIPMENT

STICKLE DIFFERENTIAL AND BOILER RETURN SYSTEMS • STICKLE OPEN FLOAT STEAM TRAPS • STICKLE REGULATING AND REDUCING VALVES • STICKLE OPEN COIL FEED WATER HEATERS AND PURIFIERS • STICKLE OIL AND STEAM SEPARATORS STICKLE TEMPERATURE CONTROLLERS AND OTHER SPECIALTIES

merged bodies traveling close to the free surface. *ASME Paper No. 47-A-112.*

The Recovery of Industrial Low-Grade Heat, *by W A Macfarlane and J M B Wason, Ministry of Fuel and Power, Great Britain.* Summary of the campaign instituted in Great Britain during the war to save fuel. Inspections of virtually every factory of importance showed that although substantial improvements could be made in boiler-house practice an equally great scope for economy was found in the application of heat to manufacturing processes. In general the paper describes ways to utilize exhaust steam or feed flash steam from one process to another operating at lower pressure. *WPC Paper No. 11, Sec. C2.*

POWER GENERATION

A Sub-Saturation Reheat Cycle, *by W E Caldwell, Consolidated Edison Co of New York.* Opening this paper is a brief treatment of conditions in central stations, which make reheat practical and necessary. Pressure, temperature and moisture limitations, which form most of this material, are discussed as they apply to gas reheating as against live-steam reheating. A suggested design for the latter form of reheating is compared with conventional practice to give approximation of economic possibilities of sub-saturation reheat. *ASME Paper No. 47-A-110.*

The 2000 Psi, 1050 F and 1000 F Reheat Cycle at Philip Sporn and Twin Branch Steam Electric Stations, *by Philip Sporn, American Gas and Electric Corp.* Basic factors, such as site, fuel, heat cycle and equipment, constitute major items in the system building program of this utility. A discussion follows of design and principal equipment of various stations on the system lines. *ASME Paper No. 47-A-87.*

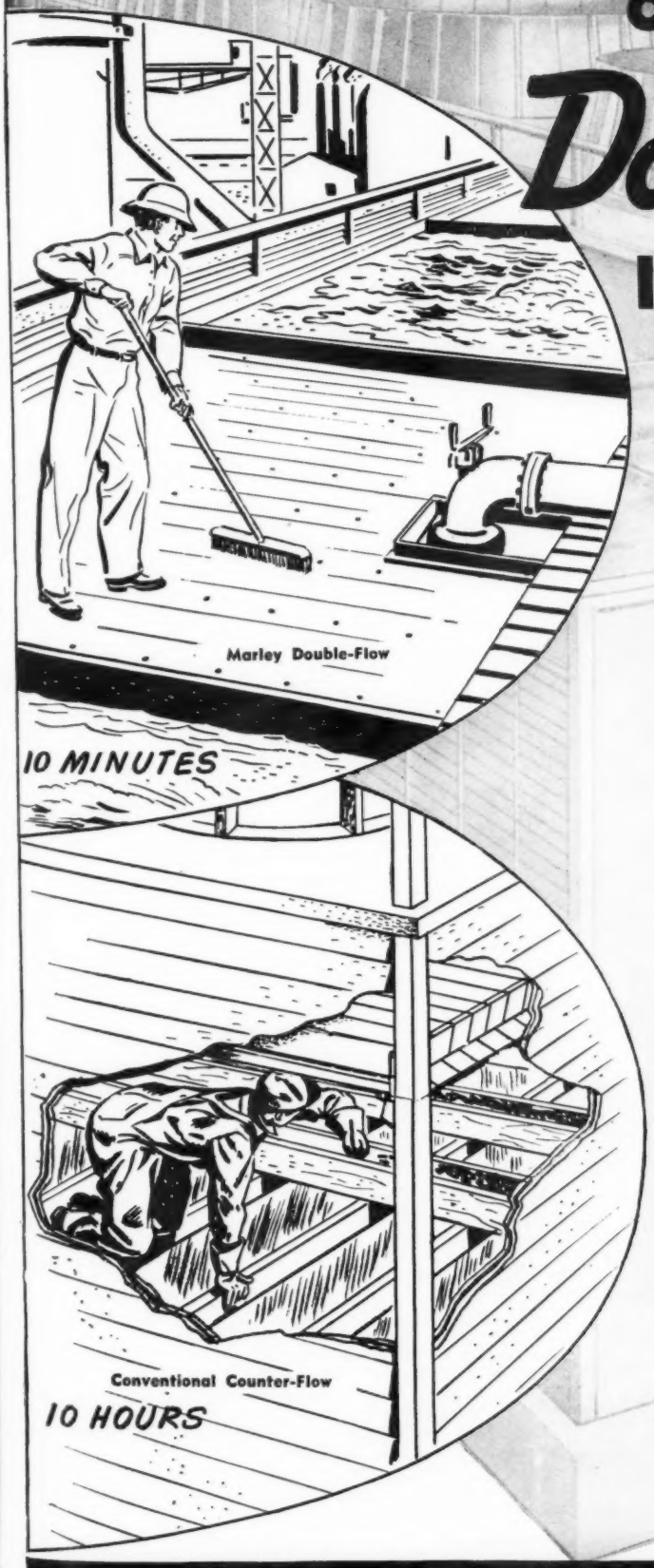
Application of Nuclear Energy to Generation of Heat and Power, *by J D Cockcroft, British National Committee, Fuel Economy Conference.* A chain-reacting pile "burning" one pound of U235 per day releases heat energy of about 500,000 kw, convertible to about 100,000 kw of electrical energy. Even with reprocessing (removing fission products at intervals) not all the U235 in natural uranium can be fissioned. This lack may be more than

Only a CLEAN Cooling Tower Is Efficient

ONLY A MARLEY

Double-Flow

IS EASILY CLEANED



To maintain efficiency in any cooling tower, the distribution system must be perfectly clean to permit maximum break-up of water. As sediment and algae accumulate, distribution is retarded . . . performance curve lowered.

Only in the *Double-Flow* open distribution system can tower condition be ascertained at a glance. *It is not necessary to shut-down entire tower for either inspection or cleaning.* If cleaning is necessary, the Double-Flow may be cleaned in minutes . . . with no accident hazard involved.

Since it is so easy to keep the Double-Flow in perfect condition, operators accept cleaning as a routine part of operation. It is not an overtime task to be shunned as laborious and dangerous.

Open distribution is just one of many exclusive features that make Double-Flow the industrial leader . . . cooling 8 Billion Gallons of water daily.

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THE MARLEY COMPANY, INC. • KANSAS CITY 15, KANSAS

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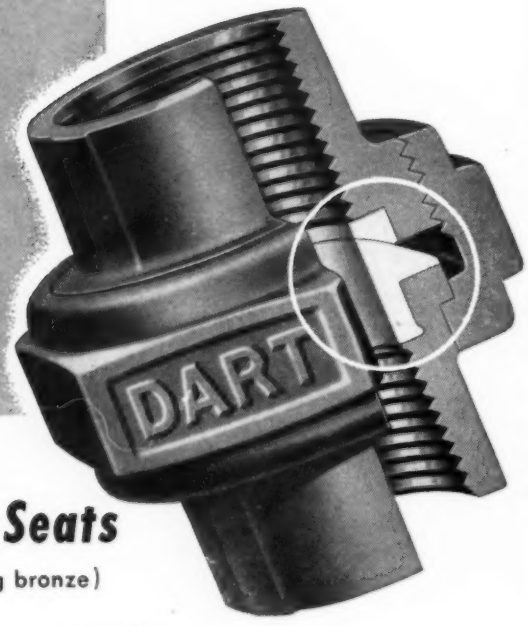

- **Extra-Wide Seats**
  (Made of non-corroding bronze)
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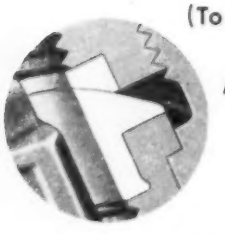
  (Made of air-refined malleable iron)
- **Extra-Heavy Shoulders**
  (To withstand strains and abuse)



And their two bronze seats are ground to a *True Ball Joint*

Darts maintain their leadership in unions by their *extra-sound* construction. Their two extra-wide bronze seats are spherical-ground to form true bearing surfaces, making a drop-tight connection. They uncouple without damage and without excessive wrench pressure and can be used in other locations, as needed, again and again. Body and nut are made of high-test, air-refined malleable iron and are practically indestructible.

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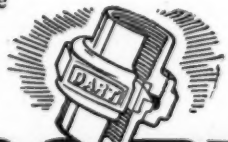


DART
UNIONS

offset by the production of plutonium in the pile from U238.

Nuclear power plants may use CO_2, helium or other fluids with low neutron absorption to absorb heat from the pile and to generate power in a gas turbine or steam in a heat exchanger.

Further experiments may prove the feasibility of "breeding piles" in which the burning of one pound of U235 produces more than one pound of by-product plutonium. This achievement would make the whole mass of natural uranium available as a fuel even though U235 is but 0.7% of the total. Then 170 tons per year would generate the entire present world's consumption of electricity. *WPC Paper No. 3, Sec. A6.*

Electronic Control of Combustion in Steam Boilers, *by Dr Ing Zdenek Ryska, Czechoslovakia, Fuel Economy Conference.* Practical technology, characterized by a marked tendency toward efficient control of boiler-furnace combustion to secure more economical use of fuels, has opened new possibilities through electronic methods. Older systems of combustion control are described and compared with the new electronic methods and the results given, particularly elimination of fluctuations of some important physical values that influence operation of boilers and indicate the chief advantages of electronic control. *WPC, Paper No.* 12, *Sec C2.*

Combined Steam and Electric Supply in New York, *by W F Davidson and M. J. Steinberg, Consolidated Edison Co of New York.* In 1934 when an extensive program was launched to modernize Waterside generating station, studies indicated large fuel saving could be made by combining power generation with steam supply for district heating. This was one of several factors that led to installation of topping turbines. With this program only partly completed, turbine exhaust in 1946 supplied 37%, or 6 billion lb of steam to the district-heating system, resulting in a large fuel saving and a 4% reduction in boiler capacity. It is estimated that when modernization is completed, about 1950, 80% of all district-heating steam will be turbine exhaust with a comparable fuel saving; it will permit shutting down lower efficiency stations for a considerable part of the time. *WPC, Paper No.* 1, *Sec C5.*

Dark Fuels: Diesel, Boiler and Gas Turbine, *by J J Broeze, Royal Dutch Shell, Netherlands.* Engine design and fuel characteristics have to go hand in hand

"HAS OPERATED 99% OF THE TIME SINCE 1939"

reports the City of St. Mary's, Ohio, of their first 2500 K W Worthington Turbine Generator.

New 2500 KW Worthington Turbine Generator recently installed in municipal power plant of the City of St. Mary's, Ohio.

Mr. George Probst
Worthington Pump and Machinery Corporation
Steam Turbine Division
Wellsville, New York

Dear Mr. Probst:

You will be interested, I'm sure, to learn that our new 2500 KW Worthington Turbine Generator has been running continuously since it was put on the line about six months ago.

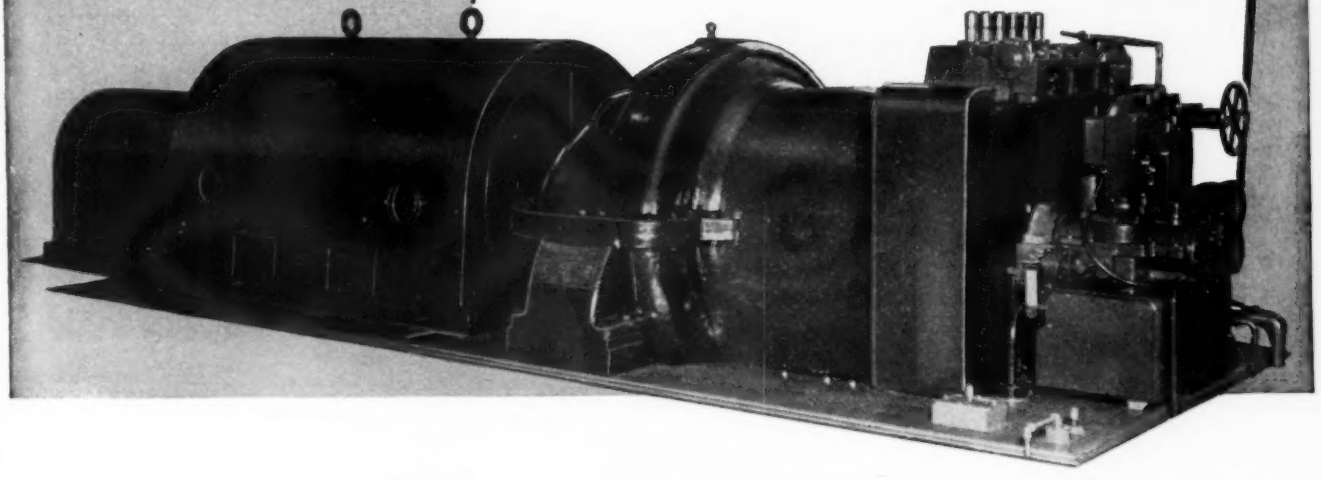
It's been eight years now since our original 2500 KW Worthington unit was started and it has operated 99% of the time ever since. On a number of occasions, it has carried loads of 3000 to 3500 KW for periods of three to four hours. We run both units a large portion of the time and they parallel very nicely.

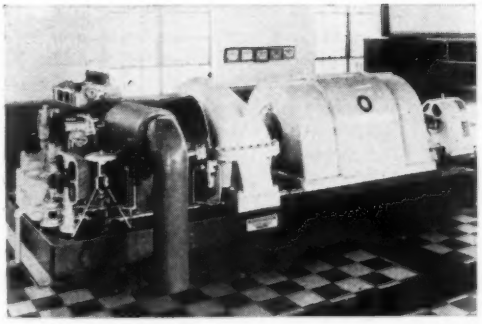
In fact, we do so well with these Worthington units that we would be glad to show them in operation to any of your prospective customers who care to visit our plant.

Very truly yours,
CITY OF ST. MARY'S

J M Hageman

City Engineer and Director
of Service and Safety





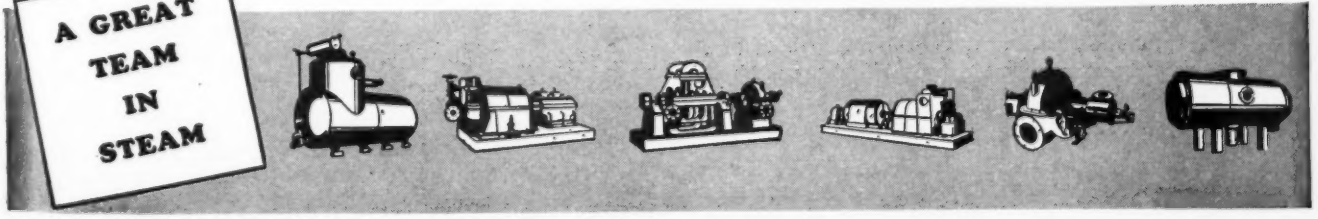
2500 KW Worthington unit installed in 1939. Turbine, straight, condensing type, operates on 400 lbs. steam pressure, 750 degrees total temperature and exhausts into a vacuum of 28"

Many similar reports from power users throughout the country testify to the trouble-free, cost-saving performance of Worthington steam turbine equipment. In your own turbine problems, Worthington specialists are always available for expert technical advice. And for further proof that *there's more worth in Worthington*, write for fact-full literature. *Worthington Pump and Machinery Corporation, Steam Turbine Division, Wellsville, N Y.*

WORTHINGTON

T7-1

A GREAT TEAM IN STEAM



5 Reasons
STRONG* 70 Series Traps
give better service!

Look to these five reasons for long, trouble-free service in STRONG 70 Series Traps:

1. *Valve and seat guaranteed leakproof for one year—made of STRONG's patented, wear-resistant Anum-Metl;*
2. *Easy servicing—permitted by the renewable seat design, cover with all working parts easily removed without breaking pipe connections;*
3. *One piece bucket—stainless steel, no welds;*
4. *Turbulence avoided, choking minimized, 25% greater capacity—with STRONG's exclusive Hi-Cap orifice;*
5. *No dribbling, quick, full opening—high ratio leverage.*

STRONG *in-line* 70 Series Traps are available in sizes from ½" to 1", semi-steel construction. STRONG's "two-in-one" blast trap with integral thermal air vent is also available in the 70 Series (see cut below).

Catalog No. 67 describes these traps in detail along with other STRONG traps. Write today.

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ANUM-METL Reg. Trade Mark

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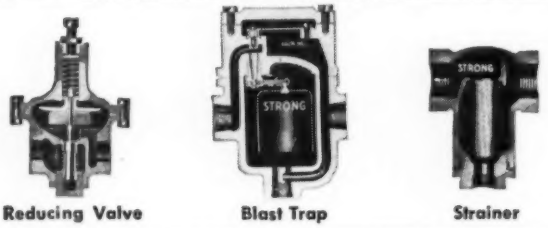


Reducing Valve Blast Trap Strainer

STRONG

for best results. Oil producers must be well aware of the fuel requirements of the engines to be served because the fuel components may be reshuffled to better advantage during refining. It seems designers, on the other hand, are not equally well informed on fuel availability.

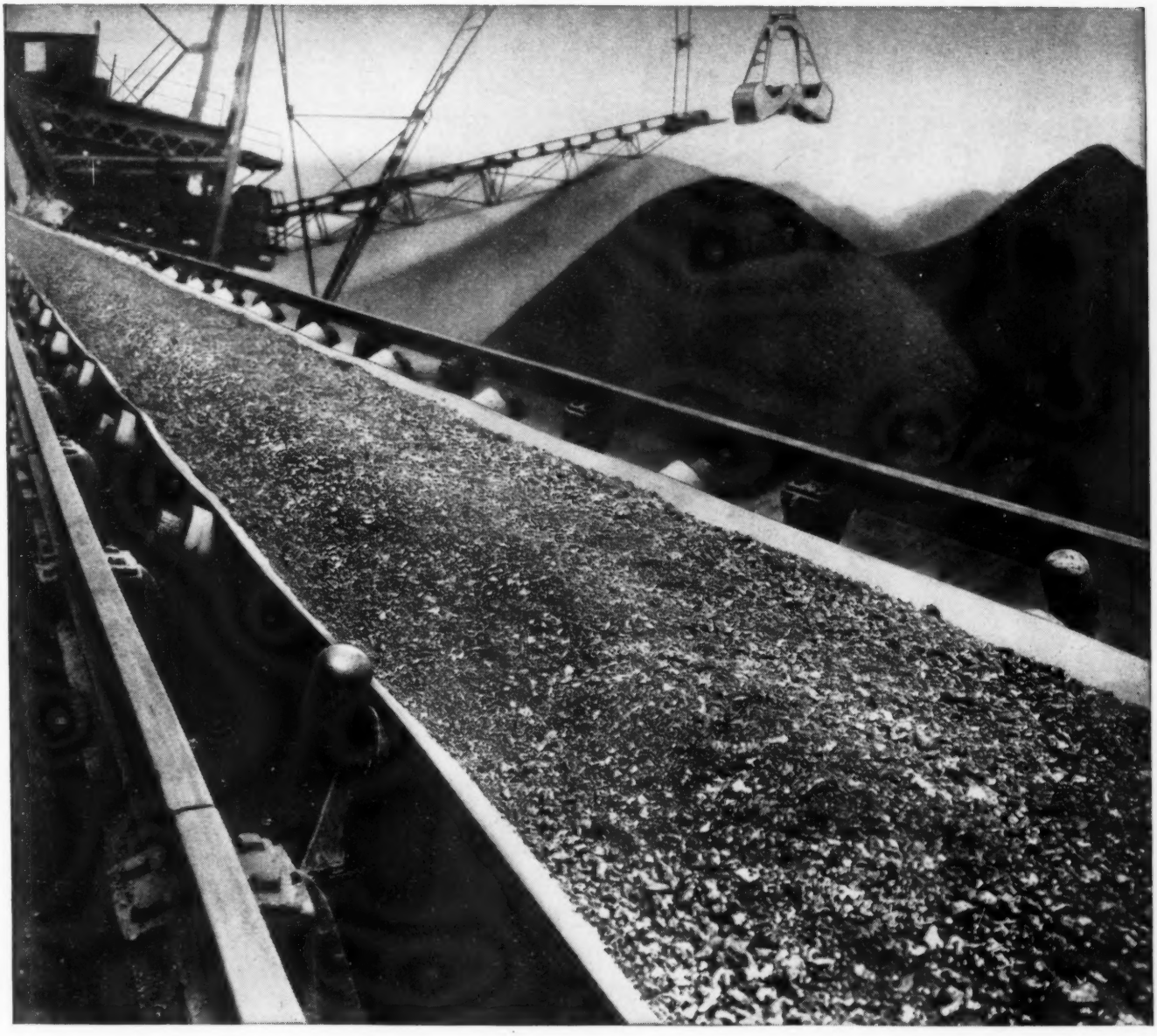
During the last ten years fuel consumption of large compression-ignition engines has not improved significantly. Most likely way of increasing over-all economy is to use less expensive grade of fuels than the diesel oils. This step requires measures to minimize maintenance, which usually increases with less volatile fuels.

Light distillate fuels should be reserved for internal-combustion engines and domestic-heating burners leaving the heavier oils for steam generation and high-temperature applications. Most significant trend during the last 15 years has been the development of automatic burners interlinked with preheating systems using the viscous fuels. These have been built for capacities up to 250 liters per hour, the majority being of the pressure-jet type, operating intermittently.

Except for aviation gas turbines, which need very light distillates, the gas-turbine designer has great freedom in the choice of combustion arrangements. This makes the gas turbine adaptable to burning almost any kind of fuel oil. In contrast to boiler needs, the gas turbine requires combustion involving a minimum of radiation factors. *WPC, Paper No. 6, Sec A3.*

Clean Waters, a 16-mm motion picture produced by General Electric Co in cooperation with U. S. Public Health Service, had been selected as one of the world's six outstanding sponsored films at the International Films of the World Festival in Chicago. This picture points out dangers of water pollution and need for adequate sewage treatment. The Festival, first U. S. or foreign film competition open to commercially sponsored movies, began Oct 11 and continued to Nov 22. Sponsors included Chicago Film Council, University of Chicago, Northwestern University and General Federation of Women's Clubs. Available for showing before any interested group, the picture has also been purchased for permanent use by 30 state health departments and more than 40 national and local organizations.

Fred M Young, president and general manager of Young Radiator Co, Racine, Wis., left recently for an extended speaking tour of the West and Northwest. His address, *Developments in Engine Cooling Systems,* will be given to members of Society of Automotive Engineers in Salt Lake City; Spokane; Seattle; Vancouver, B. C.; Portland; San Francisco, and Los Angeles.



Making molehills out of mountains

Ever stop to think that the bulk materials you have to handle, if piled together—miraculously enough—would make a small mountain?

Whether it's a mountain of stone, sand, coal, coke, gravel, copper ore, or excavated material, you want to move it at the lowest cost per ton!

The easy, quick, efficient way to move that kind of mountain is to install Robins Conveyors. They make molehills out of mountains . . . move them at speeds up to 2000 tons per hour.

Whether you're digging for diamonds, loading a coal boat or building a dam, you'll like the way Robins Conveyors cut operating costs. And you'll like their rugged construction, their simplicity of design.

What's more, Robins is the only organization that offers a complete conveyor system . . . including world-famous Hewitt belting. No need to "piece together" your conveyor system from several different sources! Robins engineers the entire job for you.

Write now for complete information on how Robins can help you. There is a Robins Conveyor to meet your individual need.

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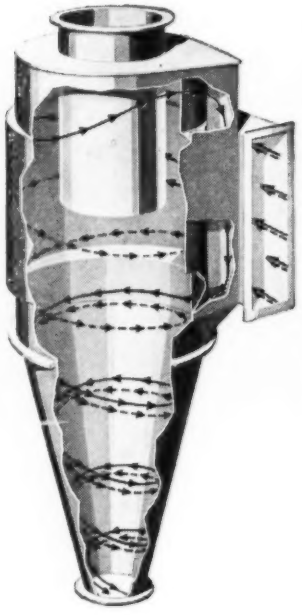
Fly-ash control

The "Brass Tacks" Approach

is to get down to fundamentals. What equipment will collect dust particles in the sizes that count, with an efficiency you can count on, and at the most practical cost.... For economy, a system's got to be simple—without moving parts or need for maintenance. That means a Buell van Tongeren Cyclone, if you really want to trap the low-micron fines, too. Only the van Tongeren has the Shave-off, to put it in the high efficiency class. A Buell catalog makes this all plain. Write for one, its "brass tacks" approach makes it easy to read.

Buell Engineering Co., 10 Cedar Street, New York 5, N. Y.



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Engineered Efficiency in DUST COLLECTION

New Equipment

(*Continued from page* 122)

one man can handle gates that would otherwise require four. Designs are available that are readily converted into a self-propelled tractor that may be used to drive a snowplow to clear a path 4 ft wide, 10 in. or more deep. **Payne Dean & Co, Madison, Conn.**

Soap Dispenser E48

ALL PLASTIC, lock-equipped, powdered-soap dispenser permits checking contents at a glance. Manufacturer claims shock-resistant amber plastic withstands repeated hammer blows. **L E Hicks & Son, Inc, 507 S Grove Ave, Oak Park, Ill.**

Gum Solvent E49

NONCORROSIVE, gum solvent removes, according to its manufacturer, tars, gums, other binders that settle out in a liquid fuel system. It is further claimed that *TANK-KLEEN* serves equally well as a reconditioner or a preventative. **Dept 101, Celco Corp, 110 E 42nd St, New York 17, N. Y.**

Pneumatic Transmitter E50

IDENTIFIED AS MODEL 42, pneumatic transmitter is designed for transmission of process measurements, such as flow, static, or differential pressure, liquid level, temperature or humidity. It is an indicator instrument, available with either eccentric or concentric scale, both being designed for easy reading. Instrument is an improved design of the previous Foxboro transmitter, most important change being a completely new transmitting element that is exactly duplicated in receiving instrument. The new design simplifies calibration. **Foxboro Co, Foxboro, Mass.**

Flexible Tubing E51

RONAFLEX TUBING consists of a tough rubber tube protected by a strong steel-wire braid to withstand abrasion, severe wear and pressure. Tube is made of specially compounded synthetic rubber to resist oil

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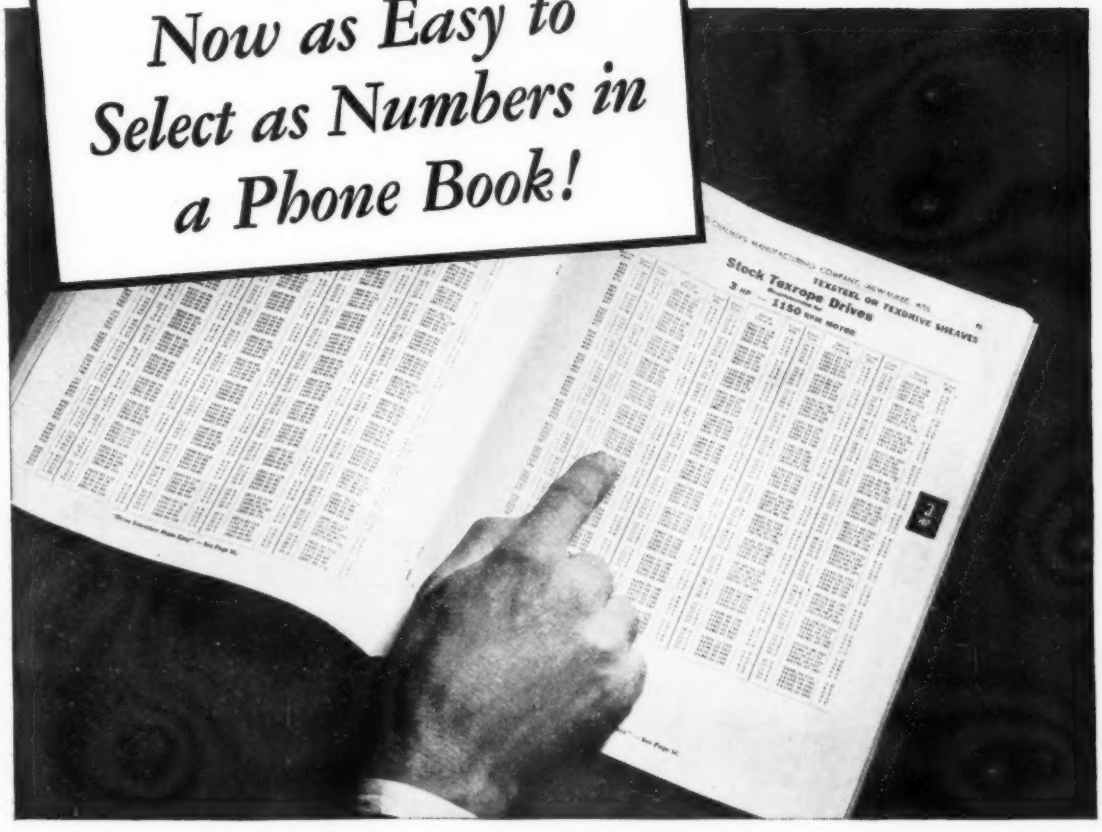
Pre-Engineered
TEXROPE V-BELT DRIVES

Now as Easy to Select as Numbers in a Phone Book!



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It puts at your fingertips *all* the information you need to solve any V-belt drive problem — quickly, correctly. It contains:

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Copies have been mailed to many Texrope users. If you do not have a copy, write for Texbook No. 20P40.

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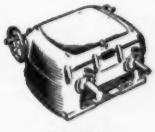
"Super 7" V-BELTS
Five Types — Sizes to suit every power transmission job.

Texsteel, Texdrive, "Magic-Grip"
— sheaves in a full range of sizes, grooves.

"Vari-Pitch" SHEAVES
Exact variations in speed, stationery or motion control.



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STANDARD
1/8" TO 3"
Cold-Working Pressure up to 2,000 pounds.

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The Catawissa seat design gives you a perfect seal for every installation -- even when the pipe is not properly aligned -- with its 55-degree angle on the female end to a ball on the male end!

HOT FORGED STEEL SWING CHECK VALVES
ESPECIALLY ADAPTED FOR HIGH TEMPERATURE & HIGH PRESSURE SERVICE!
For boiler injection--engineered to outlast the boiler! Efficient, easily accessible!

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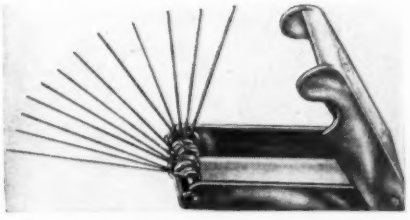
and volatiles, while braiding is constructed of either galvanized or stainless steel, aluminum or bronze. Tubing is available with high-speed, snap-on couplings for easy connection. **Ronaflex Tubing Co, Philadelphia, Pa.**

Rubber-Toothed Belt E52

A BELT WITH RUBBER TEETH does not slip and operates virtually noiselessly on pulleys grooved to fit the teeth. Belt is reinforced with steel cables embedded in oil-resisting synthetic rubber. Cable reduces stretch to almost zero, eliminating need of takeup devices to remove slack. It operates at speeds up to 10,000 fpm. Belt is made in sizes to meet machine requirements. **L H Gilmer Div, U. S. Rubber Co, Rockefeller Center, New York, N. Y.**



Cleaner Sets E53

SET OF CLEANERS for acetylene welding tips is contained in aluminum case to protect cleaners from being bent in welder's pocket. List of cleaner sizes used with different drill numbers is stamped on back of each case so correct size can be readily selected. Standard set of 12 cleaners cleans 27 drill sizes from No. 74 to 49 while special set cleans 19 drill sizes from No. 47 to 30. Cleaners are designed to clean tips without damage to insure long straight flame for clean slagless cuts. **Thermacote Mfg Co, 420 S San Pedro St, Los Angeles 13, Calif.**

Wire Pliers E54

A COMBINATION WIRE STRIPPER and wire cutter covers an unusually wide range of wire sizes from No. 10 to 22. Known as the *AMP Yellow Jacket*, because of its shockproof colored plastic handle, it incorporates a built-in wire cutter, serrated plier jaws and a handy stud-size gage. This tool eliminates necessity of carrying one or more additional tools. The accurately sized stripping notches also serve as a convenient wire-size gage. **Aircraft-Marine Products, Inc, 1416 N Fourth St, Harrisburg, Pa.**

Conductivity Cell E55

THIS WAND-TYPE CONDUCTIVITY CELL may be used as a dip cell reaching way down, or it can be permanently mounted in place. The *VO*-1 conductivity cell has a sturdy body of acid-resistant plastic, with handle at one end and electrodes of bright platinum at the other. It measures 24 in. long, and 1 in. outside diameter. For permanent mounting it is provided with a bushing of

ASBESTOS IN ACTION

This huge aircraft plant, roofed and sided with "Century" Asbestos Corrugated, will withstand a lifetime of service without maintenance or deterioration.

"Century" Asbestos Corrugated is easy to drill and cut on the job.

WHAT OTHER SHEATHING MATERIAL GIVES YOU ALL THESE ADVANTAGES?

If you're planning some new industrial construction, or remodeling, it will pay you to look into the advantages of K&M "Century" Asbestos Corrugated. Compare these features with those of any other roofing and siding material:

1. FAST, ECONOMICAL CONSTRUCTION—19 available sheet sizes speed up installation. New "Topside" fasteners eliminate costly scaffolding on roof jobs, as *all* fastening can be done from atop the roof's surface.

2. STRUCTURAL STRENGTH—"Century" Asbestos Corrugated withstands severe stresses, such as snow loads, other common conditions.

3. IMMUNITY to fire, weather, rust, corrosion, galvanic action. Being made of asbestos and cement, "Century" Corrugated cannot fall victim to these damaging forces.

4. ATTRACTIVE APPEARANCE—pleasing light gray color provides attractive, modern appearance . . . banishes that forbidding "gloom" so characteristic of many industrial plants in the past.

5. FREEDOM FROM MAINTENANCE—"Century" Asbestos Corrugated never needs painting, is highly resistant to oil, acids, brine, other destructive agents.

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Truly, here is the material adapted to today's industrial construction needs. You'll find it ideally suited to the job you have in mind. If you'd like to know more about it, just write us—we'll give your inquiries prompt consideration.

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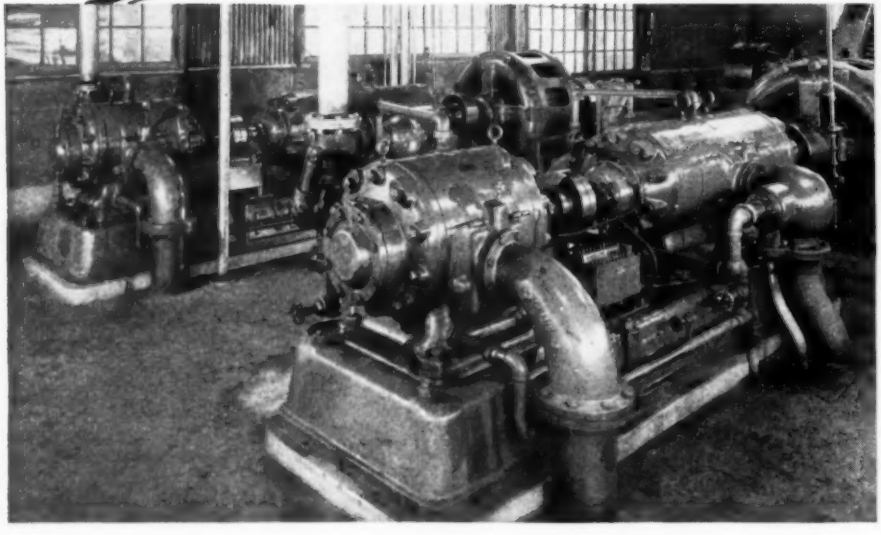
ROTARY for LONGER LIFE

Smooth No vibration



Fuller Rotary Compressors have many features of distinct advantage. Absence of vibration, together with flow of air free from pulsations, permits installation where many other types would be objectionable. Absence of vibration, together with smaller size and less weight, also simplifies and lowers the cost of foundations.

Other features and advantages to be considered are:

Maintained capacity for the life of the machine

Small floor space with relation to capacity

Few moving parts . . . no valves to leak or seats to grind

Internal parts readily accessible.

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C-161

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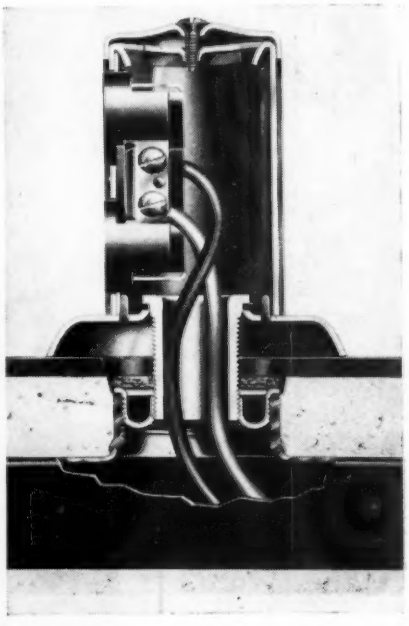
A LIFETIME OF NEW MACHINE EFFICIENCY

1 in. pipe size, or larger. Electrical connections are made by a 15-ft heavy Neoprene cable with spade-lug terminals. This construction is particularly useful where liquid to be measured is viscous or where there is a strong tendency for solids to deposit out and coat the electrodes. Design permits easy cleaning of electrode surfaces. **Industrial Instruments, Inc, 17 Pollock Ave, Jersey City 5, N. J.**



Floor Outlet E56

SIMPLIFIED NEPCODUCT SYSTEM incorporates a single size 14-gage steel under floor duct, $1\frac{3}{8}$ x $2\frac{7}{8}$ in. Steel is used for permanence and it also gives improved rounding of the system for safety. *Nepcoduct* is supplied in 10-ft lengths, and is available with either black enamel or *Sherardized* rustproof finish. It has a $1\frac{1}{2}$-in. standard pipe thread outlet. This is of particular advantage on industrial installations of under-floor duct where conduit nipples are used in a run to disconnect-switches, or to splice boxes.

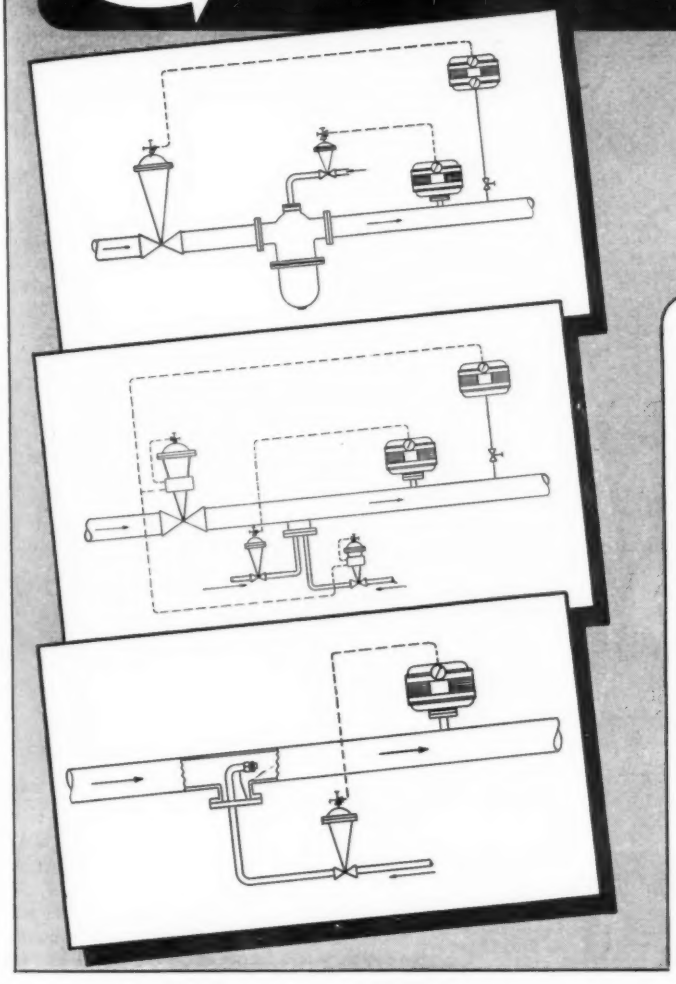
Service fittings are brass and have a standard T slot 3-pole or duplex receptacle for high potential light and power connections. Low potential service fittings are for telephone communication, or similar wiring, and can accommodate terminal blocks, buzzers, bells, and other signal devices. The simplified *Nepcoduct* system is approved by Underwriters Laboratories, Inc. **National Electric Products Corp, Chamber of Commerce Bldg, Pittsburgh 19, Pa.**

Automatic Oscillograph E57

TYPE RS-9 OSCILLOGRAPH automatically records as many as one hundred transients without attention, regardless of whether they are seconds or months apart. When a fault occurs the oscillograph starts and reaches full recording speed in 1/500 of a second (1/8 cycle on a 60-cycle system). Instrument can be supplied with built-in neutral transformer over-current and under-voltage starting relays. After starting, the *RS-9* oscillograph records until fault is cleared. It then stops automatically and

A "SINGLE PROBLEM"

Reducing and Desuperheating

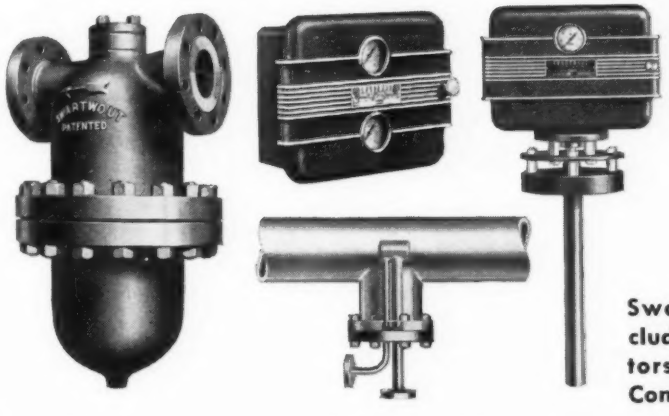


Swartwout handles your entire job of temperature and pressure reduction as a unit—assures you maximum efficiency, safety and economy.

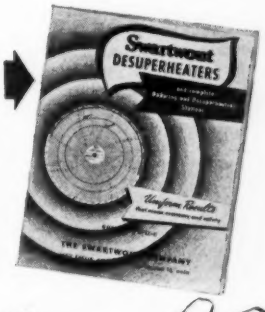
SWARTWOUT equipment brings you dependable reducing and desuperheating—quick-acting controls that guarantee properly converted steam for low-pressure turbines and process requirements, with negligible maintenance.

For many years, users and consultants generally have agreed that these important functions should not be built around hit-or-miss combinations of equipment. Your complete facilities as supplied by Swartwout bring you the advantage of properly related equipment—made by one manufacturer—working smoothly together. Besides, there are many unusual safety features possible when Swartwout engineers know all the variations of your problem.

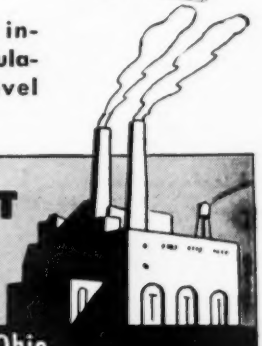
Simple design, rugged construction, easy adjustment features make Swartwout Controls constantly dependable. You save money, cut operating costs, get trouble-free efficiency from Swartwout's broad knowledge and over forty years of power plant experience.



New Desuperheater Bulletin S-21-E describes Swartwout Equipment and engineering service. Includes various hook-up diagrams. Write for your copy or 'phone the Swartwout Representative who serves you.



Swartwout Power Plant Equipment includes Feed Water Heaters and Regulators, Pressure, Temperature and Level Controls, and Regulating Valves.



Swartwout **POWER PLANT EQUIPMENT**

THE SWARTWOUT COMPANY • 18511 Euclid Ave., Cleveland 12, Ohio

Damper Regulators

ATLAS

TRADE MARK REG

What Is Your Boiler Pressure?

25 psi or less? No. 501 automatically regulates drafts of vapor or low pressure steam heating boilers. Can be adjusted to operate at any steam pressure up to 25 pounds.

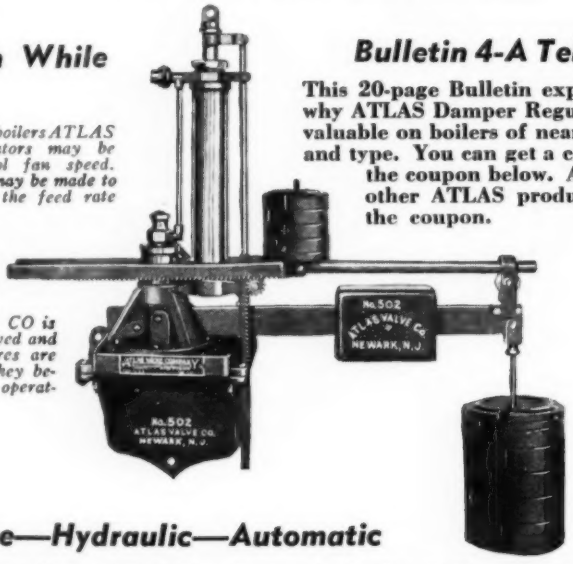
Up to 150 psi? No. 502 is the regulator pictured below. For boiler pressures up to 150 pounds. Will move damper on boiler pressure changes of ¼ pound.

400 or less? No. 503 has a Cast Iron Base construction for boiler pressures up to 250 pounds. Cast Steel Base construction for boiler pressures up to 400 pounds. Moves damper on ½ pound boiler pressure variations.

Two Worth While Features

1. *On forced draft boilers ATLAS Damper Regulators may be arranged to control fan speed. From the fan they may be made to regulate indirectly the feed rate of the stokers.*

2. *Proper and automatic adjustment of drafts and dampers keeps CO_2 where it* **should** *be. CO is avoided. Fuel is saved and flue gas temperatures are kept down where they belong for maximum operating efficiency.*



Bulletin 4-A Tells All

This 20-page Bulletin explains in full why ATLAS Damper Regulators are so valuable on boilers of nearly every size and type. You can get a copy by using the coupon below. Also, note the other ATLAS products listed in the coupon.

Sensitive—Hydraulic—Automatic

The heaviest doors or dampers are easily and quickly moved by these remarkable regulators. Ample power is always available. Water pressure is made to act automatically on a piston that is connected to the draft doors or dampers by chain. The control piston simultaneously responds to the slightest variation in steam pressure so that uniform pressure is maintained through closest adjustment of dampers. Also there is a resulting steady rate of combustion. These Damper Regulators are easy to install.

ATLAS VALVE COMPANY

REGULATING VALVES FOR EVERY SERVICE

Specialists in Regulation for Nearly a Half Century

289 South St., Newark 5, N. J.

Represented in Principal Cities

ATLAS VALVE CO., 289 South St., Newark 5, N. J.

☐ Please send Bulletin No. 4-A on ATLAS Damper Regulators. Also, please send information on the following ATLAS Products.

☐ CAMPBELL Boiler Feed Regulator
☐ Temperature Regulators
☐ Reducing Valves
☐ Exhaust Control System
☐ Pressure Regulators
☐ Pump Governors
☐ Float Valves
☐ Humidity Controllers
☐ Thermostats
☐ Balanced Valves
☐ Control Valves
☐ Oil Control Cocks

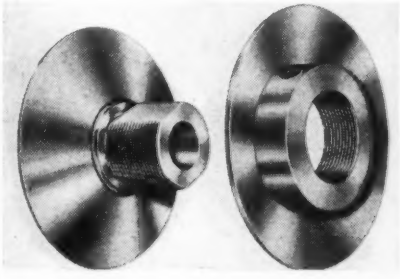
Name .....
Firm .....
Street .....
City ..... State .....

resets in preparation for next fault. Using 12 Type *OA*-2 galvanometers, the *RS*-9 records twelve quantities at once. These may be neutral current, phase current and voltages, and power. A specially-designed precision optical system assures fine-line traces and accurate records.

The *RS*-9 can be furnished without starting relays and equipment for automatic operation when it is required for manual or staged operation. It is designed for use as a portable instrument or for permanent switchboard installations. **Hathaway Instrument Co, 1315 South Clarkson St, Denver 10, Colo.**

Hand Ointment E58

TRIPLE-ACTION anesthetic control of itching from industrial rashes is the claim extended for *Dermesthetic Ointment—Cutter* by its makers. It combines benzyl alcohol, phenol and benzocaine. Benzyl alcohol acts immediately but is short-lived; phenol works at moderate speed and slow acting benzocaine provides long relief. **Cutter Laboratories, Fourth and Parker St, Berkeley 1, Calif.**



Variable-Pitch Sheaves E59

FRACTIONAL-HORSEPOWER variable-pitch V-belt sheaves have 20 threads per inch to provide finer speed adjustment than obtained with the customary 16 threads per inch. Using No. 2 fractional-horsepower V-belts, pitch diameter of 1.9 to 4.4 in. can be obtained in four ranges. Using No. 3 fractional-horsepower belts, pitch diameters of 2.4 to 4.7 in. are also available in four ranges. All sizes of sheaves can be had in three standard bores, ½, ⅝ and ¾ in. The ½-in. bore sheave has set screw only, but the other two bores have keyway and setscrews. **Dodge Mfg Co, Mishawaka, Ind.**

Speed Controller E60

ELECTRONIC SPEED CONTROL is a package unit for industrial applications of variable-speed power transmissions. When connected to variable-speed transmission it gives true speed setting automatically despite load changes. It consists of master controller calibrated in speed, the controller and a speed-measuring generator. When operator sets master controller to desired speed, the controller energizes pilot motor in correct direction for adjusting speed changer until output speed corresponds to master-controller setting. If speed varies because of load change or other cause, controller detects the error and corrects speed adjustments. It is also

Authoritative, useful Reference Material

PERTAINING TO PIPING

Published as a service to industry by the people who pioneered in welding fittings and manufacture the leading line. Return the coupon checked for the material you want.

1 TUBE-TURN CATALOG No. 111 SUPPLEMENT
Twenty pages of specifications covering new items in the constantly expanding line of Tube-Turn* welding fittings.

2 WHY AND WHERE TO USE STAINLESS STEEL PIPING
Interesting and informative, this 24-page booklet answers the question: "Why and Where Use Stainless Steel Piping?", and discusses applicable welding processes. Well illustrated.

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Booklet of pressure tables, covering welding fittings in all sizes, all weights and all regularly manufactured materials, for Power Piping, Oil Piping, Heating Piping, Gas Piping, Refrigeration Piping.

5 FLANGE PRESSURE-TEMPERATURE RATINGS
A booklet giving you the revised ratings adopted as a war measure to utilize the full strength of Flanges, Flanged Fittings, and Valves with dimensions according to ASA B16-1939.

*T. M. REG. U. S. PAT. OFF.

6 CHART OF PIPE & FITTINGS MATERIALS
A very helpful quick-reference chart covering ASTM and other specifications, Chemistry, Service Temperature Limits and Welding Data on carbon, intermediate alloy, stainless and special analysis steels.

7 TUBE-TURN STAINLESS STEEL WELDING FITTINGS AND FLANGES
A book of technical data and buying information covering a wide range of styles and sizes of stainless steel welding fittings and flanges in types 304, 316, 347.

8 FATIGUE TESTS OF WELDING ELBOWS AND COMPARABLE DOUBLE-MITRE BENDS
A research paper presented before A.S.M.E. Analyzes effects of bending in the plane and bending transverse to the plane of curvature, and bending with and without internal pressure.

9 DIMENSIONAL DATA AND WEIGHTS
A folder of man-size tables giving you dimensional information concerning Tube-Turn welding fittings from ⅛" to 30" in standard weight and extra strong, and flanges in all sizes and weights.

10 VOLUMETRIC CAPACITIES OF TUBE-TURN WELDING FITTINGS
A handy booklet giving capacities in cubic inches of Tube-Turn welding Elbows, Returns, Caps, Lap Joint Stub Ends, Crosses, Reducers, and Reducing Outlet Tees in their full range of sizes.

11 TUBE-TURN GROOVE TYPE WELDING RINGS WITH KNOCK-OFF SPACER PINS
A folder of data about a major new development for better pipe welding—a perfectly engineered welding ring that assures exact root gap spacing and complete penetration.

TUBE TURNS, INC., DEPT. 40, LOUISVILLE 1, KY.

Please send Tube-Turn reference material indicated by the numbers I have checked below. I understand there is no obligation.

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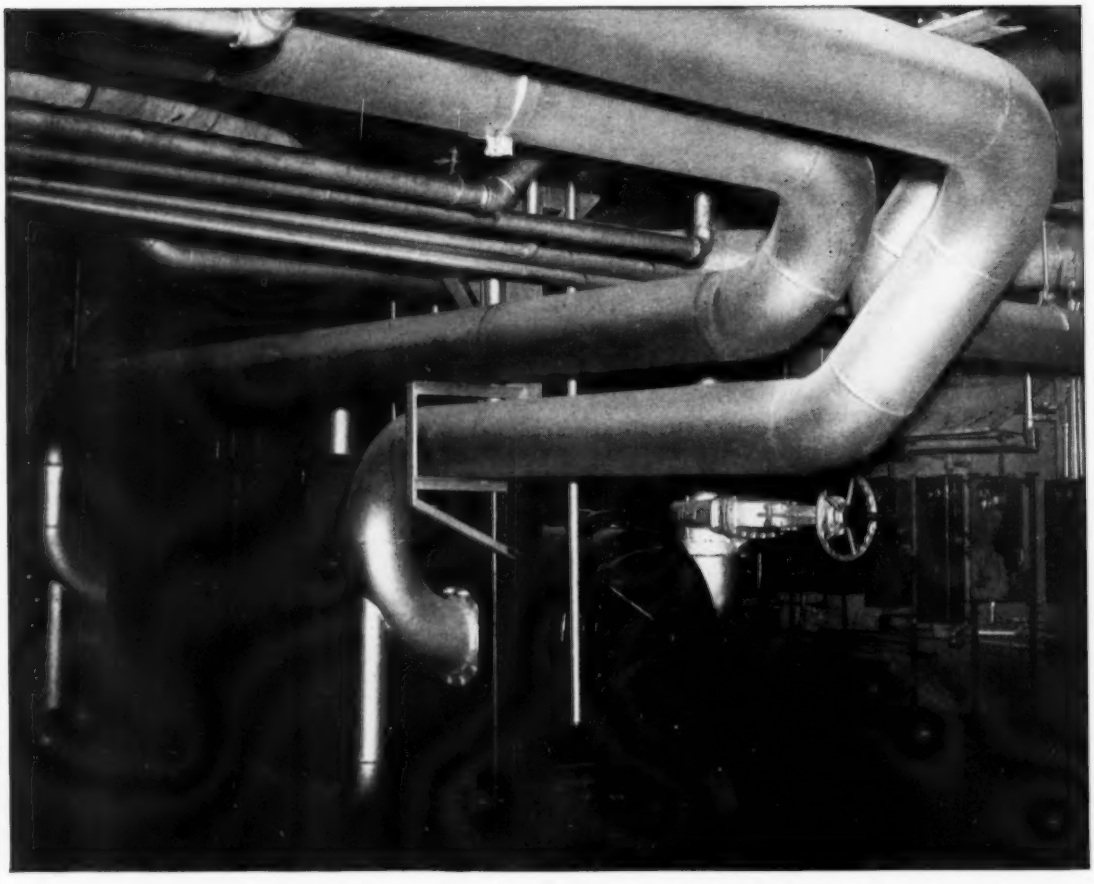

In the Power industry, Tube-Turn welding fittings provide greater safety through forged-in strength and leakproof connections, give years of trouble-free, efficient operation.

Piping Perfection for ALL Industry

When Tube Turns, Inc. pioneered welding fittings, industry at large received a multi-million dollar boost in increased piping efficiency.

Tube-Turn welding fittings add superior, *forged-in* strength to any industrial piping system. Light in weight, and forming a continuous, leakproof connection with the pipe, Tube-Turn fittings are easy to install, simplify insulation. Absence of crevices and projections within joints reduces corrosion and erosion, also facilitates flow.

Backed by the nation's foremost welding fitting manufacturing experience, Tube-Turn welding fittings—*the fittings that become part of the pipe*—are quality-controlled for dependability, are readily available in the widest range of types, sizes, metals and alloys.

In addition to more than 4000 items in grade A and grade B carbon steels, Tube-Turn welding fittings and flanges are manufactured in wrought iron, copper, Monel metal, stainless steels, carbon moly steels, aluminum, brass, Inconel, nickel

TUBE TURNS, INC., LOUISVILLE 1, KENTUCKY

District Offices at New York, Philadelphia, Pittsburgh, Detroit, Chicago, Houston, Tulsa, San Francisco, Los Angeles

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Welding Fittings and Flanges

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KNOWN SINCE 1893 FOR DEPENDABLE PIPING

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Benjamin F. Shaw Company is qualified to pre-fabricate and erect piping — any place in the United States and Canada.

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December 27, 1947

Mr. Benjamin F. Shaw II, President
Benjamin F. Shaw Company
2nd & Lombard Streets
Wilmington 99, Delaware

Respected friend:

My calendar tells me that twelve months have gone their way into the past since I wrote you last December 27th.

In this rapidly changing world, business conditions become more confusing each day for all of us, and it is with deep gratitude that we again acknowledge the efforts made by your good firm, and staff as well, to keep us supplied throughout the trying year just ending.

Our contacts with your organization have always been friendly and pleasant and we look forward to the continuance of these same relations for many, many years to come.

With all good wishes to you and your associates, we are

Respectfully your friends,
JOSEPH BANCROFT & SONS CO.

W. R. MacIntyre,
President

MEMBER OF NATIONAL ASSOCIATION OF FINISHERS OF TEXTILE FABRICS

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OUTSTANDING PERFORMANCE

that means

$SAVINGS FOR YOU

The water or liquid to be measured enters the measuring chamber tangentially, spinning in the chamber as it passes through, forming a vortex. Each gallon that passes through this chamber makes the same number of revolutions of the water. The vane in the rotating water imparts the rotation to the register of the

HENSZEY *FEED WATER* METER

Yes, — it's as simple as that. No close clearances . . . no complicated mechanisms — all of which means savings for you. Savings in installation, savings in continued performance, savings resulting from accurate measurement of the liquid.

Henszey Meters are equally accurate at high or low flow . . . high or low pressures . . . on reciprocating or centrifugal pumps. Calibrations can be made to read in gallons, pounds or cubic feet at any specified temperature.

If you have a tough measuring problem that involves boiler feed water, boiler blowdown, condensate, chemicals or other hard-to-measure liquids, consider a Henszey Meter . . . contact your nearest Henszey representative or write to

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FEED WATER METERS

Continuous Blowdown • Distillation Systems • Heat Exchangers
Boiler Feed Regulators • Flow Indicators • Proportioning Valves
also MILK EVAPORATORS and PRE-HEATERS

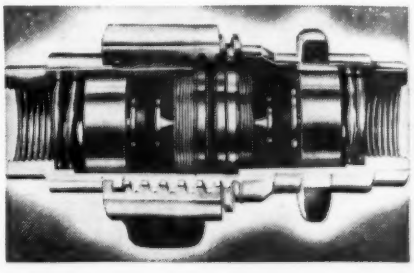
used to maintain precise speed ratio between several isolated loads, such as conveyors. **Yardeny Laboratories, Inc, 105 Chambers St, New York 7, N. Y.**

Solder E61

PASTE-FORM, single-application solder covers three ranges, 200 to 500 F, 500 to 750 F, 1150 to 2000 F. One application performs cleaning and fluxing, tinning and soldering. Solder is separately compounded for each application, such as electrical, sweated fittings, sheet metal, etc. **Fusion Engrg, 1836 Euclid Ave, Cleveland 15, Ohio.**

Multi-Way Valves E62

TWO-, 3- AND 4-WAY VALVES are for use with company's gear pumps. Some designs have integral relief valves to control system pressure and a neutral position to unload pump between operating cycles. **Aro Equipment Corp, Bryan, Ohio.**



Quick-Disconnect Coupling E63

DESIGNED FOR RAPID CHANGE of air-conditioning units on railroad passenger cars, coupling is applicable to air, gas and hydraulic systems. Fast *Acme* thread permits rapid opening of union joints. Dual valves are self closing when union is broken. Design of unit provides for relieving pressure between valves while being disconnected and for trapping a minimum of air between valve seats when making up the union. Valve seats, of Freon-resisting *Neoprene*, are easily replaceable. Coupling is made in ½- to 1½-in. sizes. It seals easily under high pressures in Freon refrigeration systems. **Paxton-Mitchell Co, 27th & Martha St, Omaha 5, Neb.**

Heavy-Duty Jack E64

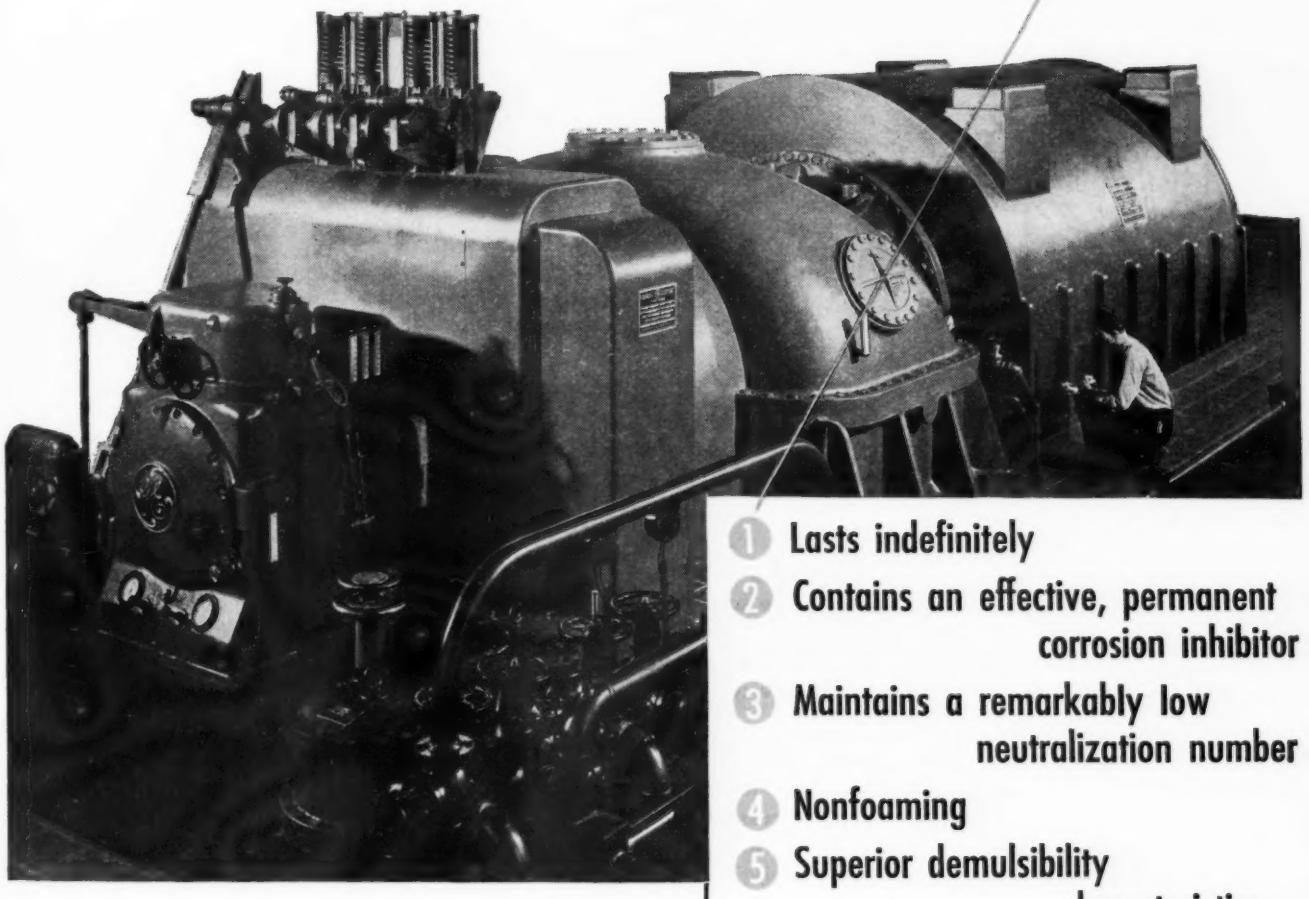
BLACKHAWK HEAVY-DUTY HYDRAULIC JACKS, the 30-ton *FB*-11, and the 50-ton *GB*-11, combine load and speed pump in one unit. Other features include a recessed safety-release valve, over-all closed construction, ports for gage or valve installation, pump beam protection, carrying handle, and on-the-side operation. **Blackhawk Mfg Co, Milwaukee 1, Wis.**

Liquid Filter E65

NEW LIQUID FILTER, known as Fig. 1116*PY*, Size 1*S*, comes in sizes between 1*R* and 4*R*. When filtering lubricating oil of 200-ssu viscosity oil, capacity is 2½ gpm at about 3-psi pressure drop through the filter. Size 1*S* uses either a bag or absorbent-type material for filtering medium. Either style

5 REASONS

Why Gulfcrest Oil WCR is the logical choice for your new turbine



1. Lasts indefinitely
2. Contains an effective, permanent corrosion inhibitor
3. Maintains a remarkably low neutralization number
4. Nonfoaming
5. Superior demulsibility characteristics

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Please send, without obligation, a copy of your booklet "Gulfcrest Oil for Steam Turbine Lubrication."

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Wherever it stops you'll find Zallea Expansion Joints selected as the ideal medium for absorbing axial and lateral movement due to thermal changes in all kinds of pipelines.

A central heating plant in Iceland, a refinery in Texas, a power plant in India . . . all over the world engineers have selected Zallea Expansion Joints for dependable performance. And here's why . . . **No packing to deteriorate . . . No maintenance required . . . Longest service life assured.**

There's a Zallea Expansion Joint for almost any application —made of copper, stainless steels or other corrosion-resistant alloys in diameters from 3" upward for temperatures from sub-zero to 1600° F. Available for pressures from vacuum to 300 psi in standard designs and up to 1000 psi in special designs.

You'll want this brand new 60-page Zallea Catalog 47 which describes these joints, their manufacture and how to select the proper expansion joint for your application —all in a profusely illustrated easy-to-read form. Use it as a guide or as a permanent reference source. Write for it TODAY to: *Zallea Brothers and Johnson, 814 Locust Street, Wilmington 99, Del.*

Zallea
EXPANSION JOINTS

WORLD'S LARGEST MANUFACTURERS OF EXPANSION JOINTS EXCLUSIVELY

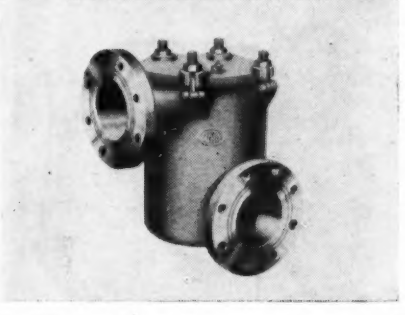
may be used for fuel or lubricating oil—straight mineral or heavy-duty additive oils—and will not remove or affect the additive. Bag filters come in sizes from ¼- to 400-gpm filtering capacity, depending on viscosity and pressure. Filter has a built-in relief valve for safety if cleaning is neglected or oil is cold and viscous upon starting. If such protection is provided in connecting piping, built-in relief valve is omitted. **Wm W Nugent & Co, Inc, 410 N Hermitage Ave, Chicago 22, Ill.**

Welding Flux E66

DESIGNATED AS AIRCO FORMULA NO. 34, new welding flux has been specifically compounded to dissolve chromium oxides encountered in welding stainless steel and other high chromium-bearing alloys. It replaces the flux known as *Kromeweld*. It is available in ¼- and 1-lb cans. **Dept 1630, Air Reduction Sales Co, 60 E 42nd St, New York 17, N. Y.**

Condensate System E67

NEW CONDENSATE-RETURN SYSTEM provides constant flow of steam and rapid return of high-temperature condensate to the boiler. Manufacturer says that all water fed to the boiler is deaerated by effective liberation of free oxygen and non-condensible gases. Systems are available for steam pressures up to 250 psi. It requires no pumps or other mechanism for operation. **W M Acker Organization, 3167 Fulton Rd, Cleveland, Ohio.**

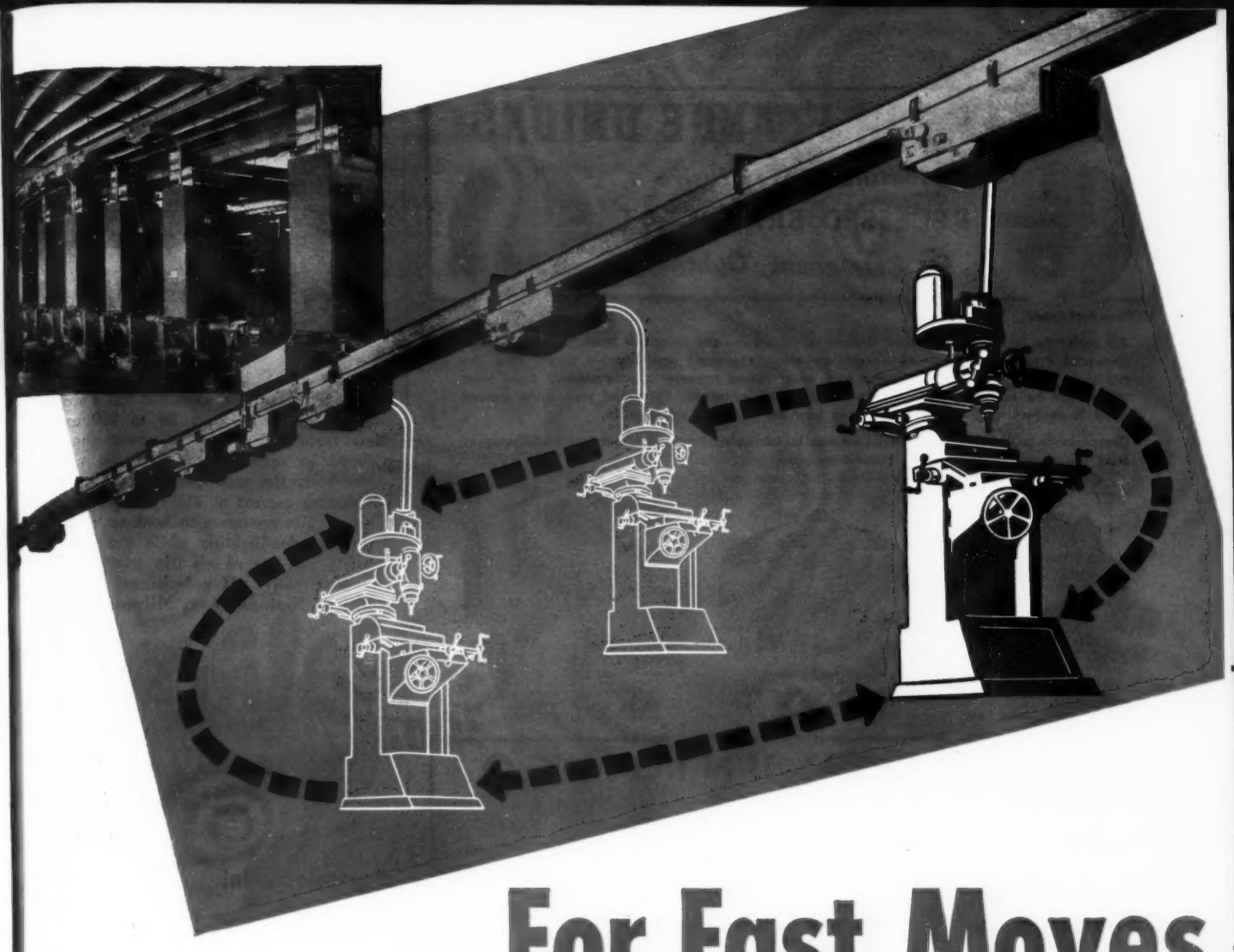


Pipeline Strainer E68

OFFSET STRAINER permits complete draining with the line. With inlet and outlet at right angles, strainer may be installed to form a right angle connection in a piping system. Cover is removable for lifting out perforated strainer basket. Cleanout plug permits steam blowdown cleaning when practical. Made in cast bronze, steel, semi-steel or iron, or alloy metals for corrosion resistance. Models are available for working pressures from 125 to 300 psi in sizes from 1½ to 12 in. in diameter, with flanged, screwed or welding connections. **J A Zurn Mfg Co, Erie, Pa.**

Welding Rod E69

EUTECROD 188 welding rod has a maximum hardness up to 67 Rc. The new alloy has a bonding temperature of 1800 F and remelts at 1950 F. In addition to



For Fast Moves

Relocate machines with no delays for rewiring

Power can be taken off wherever needed with this convenient, flexible and economical distribution system.

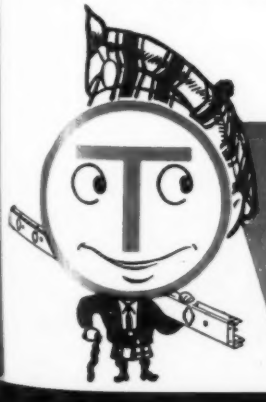
Power where you want it — with Trumbull FLEX-A-POWER Plug-In Busways—gives you maximum flexibility in machine arrangement without the cost and nuisance of rewiring each time you change the layout.

With FLEX-A-POWER Plug-In Busways covering your whole plant, you can move a machine or a whole line of machines with no interruption of power. Convenient outlets every 12 inches permit plug-ins *right at the load.*

Even when major changeovers require moving an entire department, the FLEX-A-POWER system can be moved along, too — dismantled, removed and reinstalled quickly, with practically 100% use of all materials.

That's because every part of a Trumbull Busway System is prefabricated, which of course reduces original installation and construction costs. FLEX-A-POWER is stocked in standard 10 foot lengths and is available in capacities from 250 to 1000 amp. with all necessary fittings and accessories.

Send for Bulletin. THE TRUMBULL ELECTRIC MANUFACTURING CO., Plainville, Conn. Other factories at Norwood, Ohio • San Francisco • Seattle • N. Hollywood. Sales offices and representatives in all important cities.



The OVERHEAD that pays for itself in Cost Reduction

TRUMBULL (T) ELECTRIC

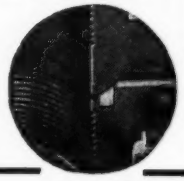
Flex-a-Power

JEFFERSON FLANGE UNIONS

feature the exclusive

RECESSED BRASS SEAT

for Permanent Tightness

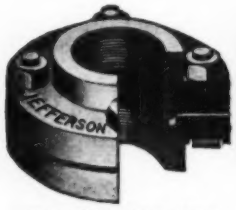


Three Part Detail — Two Part Detail

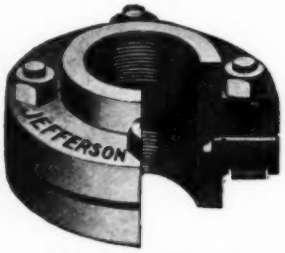
All Jefferson Unions and Flange Unions in all styles are designed around the Jefferson Recessed Brass Seat—a metal-to-metal spherically ground seat located away from the run way of the fitting. This design and construction assures a permanently tight joint which can be made up leakproof without undue pressure. Threaded pipe ends cannot come in contact with the seat no matter how far they are screwed in.

Complete details on the Jefferson line can be obtained from your nearest distributor or from Jefferson direct.

Style "B", Three Part Flange Union — for test pressures up to 2000 lbs.



Style "E", Two Part Flange Union for test pressures up to 6000 lbs.



Style "D", Two Part Flange Union for test pressures up to 4000 lbs.

JEFFERSON UNION CO.

601 West 26th St., New York 1, New York

Factories at

LEXINGTON 73, MASS. — LOCKPORT, N. Y.

"TOPS" by EVERY TEST

Capacities to 150 G.P.M. — Heads to 600 Ft.

The

APCO

TURBINE-TYPE

PUMP

- Simple — Wear-Free — Compact
- High Efficiency
- Silent Operation
- Will not Vapor-Bind
- Hydraulically Balanced
- Accessible
- High Suction Lift
- No Metal-to-Metal Contact
- High pressure per stage
- Double Suction
- Precision Shafts
- Two Outboard Ball Bearings
- Right or Left Hand Operation
- Replaceable Cover Plates

The ONLY MOVING PART IN the APCO

APCO is the highest development of the Turbine-Type Pump. No Metal-to-Metal contact. Handles NON-LUBRICATING liquids almost indefinitely without wear. Applicable for Water Supply, Boiler Feed, Condensation Return, Circulating, Transfer, Booster, Self Priming, Marine, Distillery, Dairy, Special Metal and "1001" Duties. Delivers with slight change in capacity against drastic head conditions.

AURORA CENTRIFUGAL PUMPS

A complete line, notable for streamline coordination between impellers and shells, including Horizontally Split Case, Single and Two Stage, Side Suction, Vertical, Non-Clog, Sump, Mixed Flow, Deep Well Turbines. Special Design, etc.

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AURORA Always PUMPS

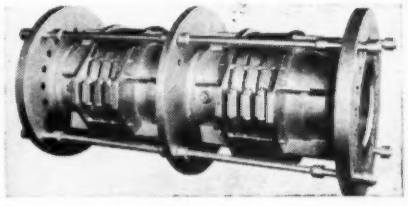
AURORA PUMP COMPANY

50 Loucks Street, AURORA, ILLINOIS

producing overlay hardness on copper, alloy applies equally well to steel and ferrous metals without dilution with base metal during welding. Applications include bearings, gears, centrifugal pumps, globe or gate valves, oil-jet nozzles, and other machinery where corrosion resistance is important. **Eutectic Welding Alloys Corp, 40 Worth St, New York 13, N. Y.**

Portable Welder E70

P & H MODEL WN-200 WELDER, available as a trailer or stationary unit, is a NEMA rated machine at 200 amp, but has a welding service range from 30 to 260 amp. New feature is its extra power supply. Offered as optional equipment at small extra cost, the unit provides 1½ kw of alternating current at 115 v, single phase. This enables operators to hook-up electric lights for floodlighting while welding, or permits the use of electric power tools. **Welding Div, Harnischfeger Corp, 4400 W National Ave, Milwaukee 14, Wis.**



Expansion Joint E71

NEW EXPANSION JOINT consists of two corrugated elements linked together by a section of pipe. Amount of lateral movement that can be absorbed depends on pipe length between corrugated elements. Expansion elements can be either of nonequalizing type for pressures up to 30 psi, or self-equalizing for higher pressures. **Zallea Brothers & Johnson, 888 Locust St, Wilmington 99, Del.**

Atmospheric Regulator E72

SERIES 18 SOFT-SEAT REGULATOR features tight shutoff when demand for gas flow ceases, by incorporating a soft, synthetic rubberized fabric facing on regulator valve head. Regulator supplies gas at pressures from 2 to 16 oz. It is made in sizes ¾, 1, 1¼, 1½, 2, 2½, and 3 in. with capacities ranging up to 16,000 and 19,000 cu ft per hr of natural gas and manufactured gas, respectively. **North American Mfg Co, 4455 E 71st St, Cleveland 5, Ohio.**

Solenoid Valve E73

NEW SOLENOID VALVE is compactly built for all hydraulic systems, or for handling any non-corrosive fluid. It has a maximum working pressure of 3000 psi, and electrical requirements of 6, 12, 24 or 36 v dc, with current consumption of 2.3 amp at 12 v. Valve is available with integral flow-rate regulation. **Waterman Engrg Co, 721 Custer Ave, Evanston, Ill.**

HERE is a quick-steaming unit expressly designed for maximum output in a limited space. Edge Moor design has combined a simple two-drum boiler bank, having perfect U-tube circulation, and a water-cooled furnace, integral with the boiler. Rapid response to load changes is assured by the great amount of surface exposed to radiant heat. This unit is adaptable to all fuels and is available in all sizes.

This and other types of Edge Moor boilers are available in a wide range of capacities, pressures and accessory equipment. Write for literature today. EDGE MOOR IRON WORKS, INC. Main Office and Works: Edge Moor, Delaware. Branch Offices and Agents: Atlanta, Boston, Chicago, Detroit, Hoboken, St. Paul, San Antonio and San Francisco.

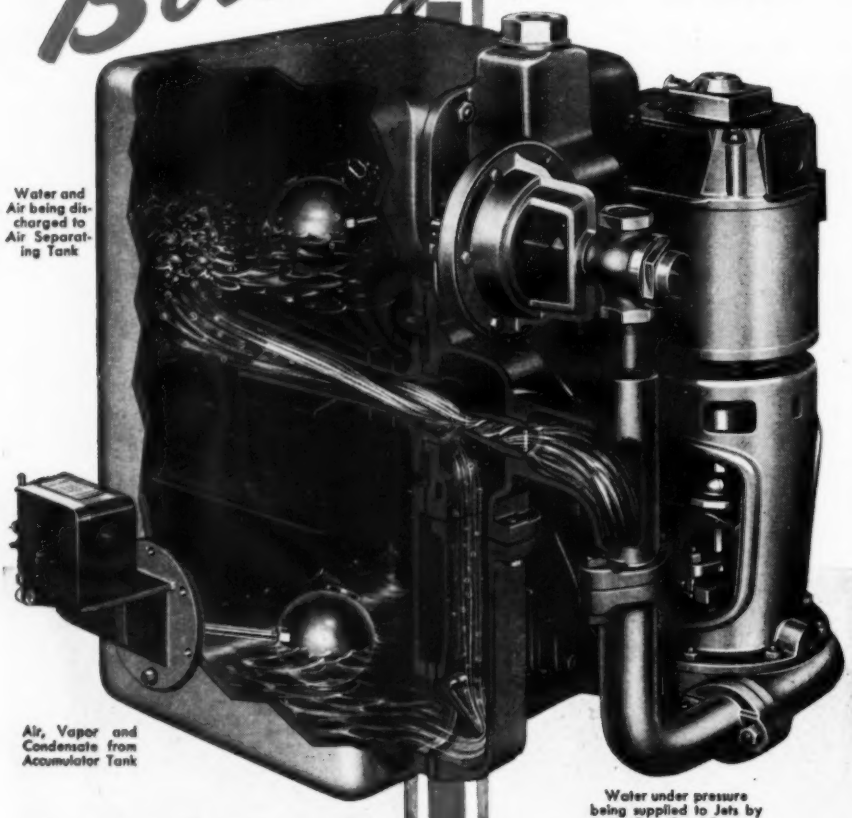
● Edge Moor Vertical Flow Unit with Edge Moor superheater and air heater fired with continuous discharge spreader stoker. 40,000 lbs. steam per hour, 400 lbs. pressure, 750° F. total steam temperature.

edge moor

steam generating equipment

EM

HANDLES WATER ALMOST AT THE *Boiling Point*


Water and Air being discharged to Air Separating Tank
Air, Vapor and Condensate from Accumulator Tank
Water under pressure being supplied to Jets by the Centrifugal Pump

If excessively hot condensate is causing pump trouble in your heating plant, Hoffman-Economy offers positive relief. The exclusive Jet-Type Vacuum Producer featured in the Hoffman-Economy Vacuum Pump assures efficient operation under conditions ordinarily impossible. *It is the simplest and most effective method for exhausting air and water at high temperatures.* At 195° and 3" vacuum, this pump discharges 85% of rated capacity in air and 100% in water, *simultaneously!*

In every other respect this pump is built to meet and even anticipate modern pumping requirements. All cast iron and bronze construction... stainless steel shaft — noiseless... and easy accessibility to all parts.

Hoffman-Economy Type "E" Condensation Pump with vertical pump and motor assembly.

KEEPS STEAM LINES CLEARED FOR ACTION

Better plant operation begins with efficient condensate return

HOFFMAN ECONOMY PUMPS

Send for illustrated catalog.

HOFFMAN SPECIALTY CO.
Dept. P-2, 1001 York St.
Indianapolis 7, Ind.

Famous for Hoffman Valves, Traps, Vacuum and Condensation Pumps, Forced Hot Water Heating Systems.

Power News

(*Continued from page* 132)

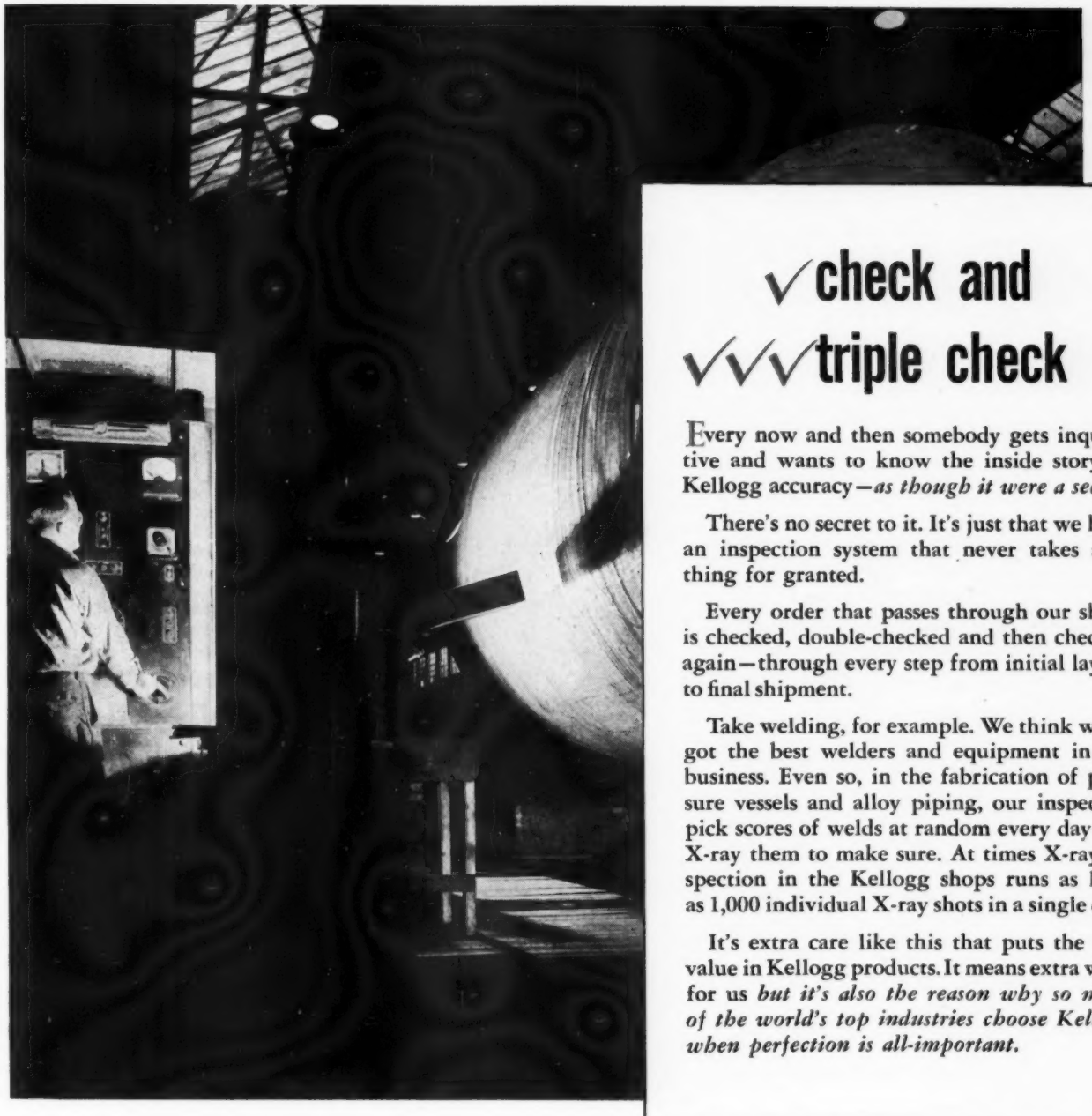
disclosed in a recent lecture at Birmingham. It will take a good many years to get a really important contribution to the nation's power supply from atomic energy, Professor Moon said, but there is no practical doubt that it will come in time. Preparations are being made for producing materials in Britain that could be used at will for making atomic bombs or for generating heat.

Meanwhile, a number of British businessmen, who will advise the Government in industrial application of atomic energy and who will assist in construction of the large-scale atomic-energy plant at Sellafield, West Cumberland, have been let in on some of the hitherto top-secret information on nuclear fission. The names, however, have not been revealed.

One of the world's largest diesel-electric plants—rated at 30,000 kw—is under construction at Mexico City. Lack of rainfall has caused an impending power shortage in the Mexican capital and the surrounding area, predominantly served by hydro. Steam plants are now being built and to further assure an adequate and instantaneous supply of power, Comision Federal de Electricidad, under direction of Alejandro Paez Uriquidi, has ordered the diesel plant. The first of six engines will be ready for delivery in May, and one additional engine will be shipped in each succeeding month.

The engines, built by Nordberg Mfg Co, are 12-cyl 29x40-in. 167-rpm 2-cycle units rated 8650 bhp at sea level. At Mexico City's elevation of 7400 ft, each will deliver 7325 hp and drive a 5000-kw 3-phase 50-cycle 6600-v General Electric generator. The engines, fitted with motor-driven scavenging blowers, will operate in parallel with each other and with existing hydro and steam plants.

Westinghouse Electric Corp has reported plans to more than double its production of air-conditioning equipment in 1948. Under the new program, Westinghouse air-conditioning equipment will be sold principally through these four franchised channels: (1) general engineering distributors, who will specialize in engineered installation of field- and factory-assembled equipment, (2) general engineering and self-contained air-conditioner distributors, who, in addition to engineered installations, will distribute and merchandise factory-assembled units through their own organizations and through dealers, (3) self-contained air-conditioner distributors, who will sell directly and through dealers, factory-assembled self-contained air-conditioning units with capacities up to 25 tons, (4) self-contained air-conditioner dealers, who will sell such factory-assembled units up to five tons. In addition, there is a headquarters syndicate sales organization, with offices in New York, to support national syndicate and chain store sales.



✓check and ✓✓✓triple check

Every now and then somebody gets inquisitive and wants to know the inside story of Kellogg accuracy—*as though it were a secret.*

There's no secret to it. It's just that we have an inspection system that never takes anything for granted.

Every order that passes through our shops is checked, double-checked and then checked again—through every step from initial layout to final shipment.

Take welding, for example. We think we've got the best welders and equipment in the business. Even so, in the fabrication of pressure vessels and alloy piping, our inspectors pick scores of welds at random every day and X-ray them to make sure. At times X-ray inspection in the Kellogg shops runs as high as 1,000 individual X-ray shots in a single day!

It's extra care like this that puts the plus value in Kellogg products. It means extra work for us *but it's also the reason why so many of the world's top industries choose Kellogg when perfection is all-important.*

FABRICATED PRODUCTS DIVISION

THE M. W. KELLOGG COMPANY

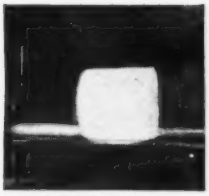
A SUBSIDIARY OF PULLMAN INC.

NEW YORK • JERSEY CITY • BUFFALO • LOS ANGELES
TULSA • HOUSTON • TORONTO • LONDON • PARIS

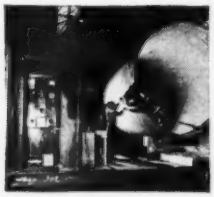
VESSELS • EXCHANGERS • CONDENSERS • HIGH PRESSURE AND HIGH TEMPERATURE POWER PIPING
PROCESS PIPING • FORGED AND WELDED FITTINGS . . . IN ALL STEELS, ALLOYS OR SPECIAL COMBINATIONS

Metallurgical Research conducted continually by recognized specialists who have made major contributions in this field.

Unique Technical Backing of an extensive organization with an international reputation in both process and fabrication engineering.

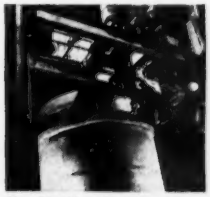


Complete Facilities for the fabrication of steel products from simple forgings to the most intricate 120 foot towers.



Quality Control embracing the constant application of the most advanced inspection methods, both visual and non-destructive.

On-Time Delivery made possible by a flexible planning group authorized to re-route work to meet promised dates.



Top Welding Performance assured by specially designed equipment and exclusive employment of master operators.

IMPORTANT
maintenance savings
with Laminum,
the solid shim that
p-e-e-l-s for adjustment

Repair and maintenance time is costly. Users appreciate LAMINUM shims that are adjustable to compensate for wear of bearings, gears, shafts, slides, and other moving parts.

Install LAMINUM as standard equipment on the machinery you build. Assembly time and costs will be reduced. Maintenance costs will drop for the users.

Write for data and application chart.

●

LAMINUM shims are cut to your specifications. Packaged shim stock for repair and maintenance work is sold only through industrial distributors.

Laminated Shim Company, Inc. 3028
Glenbrook, Connecticut

LAMINUM
TRADE MARK
THE SOLID SHIM THAT peels FOR ADJUSTMENT

At DEMA meeting: (left to right) Gordon R Anderson, director of engrg, Fairbanks, Morse & Co; Emil Grieshaber, chief engineer, Nordberg Mfg Co; E J Schwanhausser, vice-president, Worthington Pump & Machinery Corp; Ralph Boyer, vice-president and chief engineer, Cooper-Bessemer

DEMA Elects Officers At Annual Meeting

Gordon Lefebvre, president of Cooper-Bessemer Corp, was elected the new president of Diesel Engine Manufacturers Assn at the annual meeting Dec 10 in Chicago. Otto H Fischer, president of Union Diesel Engine Co, and L W Metzger, vice-president of Baldwin Locomotive Works, were elected vice-presidents. Robert H Morse Jr, vice-president and general sales manager of Fairbanks, Morse & Co, was reelected treasurer, and Harvey T Hill was reappointed executive director.

Elected to serve two years on board of directors were George Codrington, vice-president of General Motors Corp and general manager of Cleveland Diesel Engine Div; E J Schwanhausser, vice-president of Worthington Pump & Machinery Corp; A W McKinney, vice-president of National Supply Co; Messrs Morse and Metzger.

The following were elected to serve one year on the board: C S Herbert, executive vice-president, Enterprise Engine & Foundry Co; W E Corrigan, vice-president, American Locomotive Co; Robert E Friend, president of Nordberg Mfg Co; Messrs Lefebvre and Fischer.

Annual meeting, together with DEMA engineers' session held on Dec 9 and 10, comprised an important and successful gathering. Significant issues were discussed and progress was made in solving diesel problems.

A 10,000-hp 3600-rpm synchronous motor, double the largest ever built for this high speed, will soon be in manufacture at the Westinghouse plant. It will drive two Sturtevant blowers, one mounted on each end of a double-end shaft to provide air for testing ram-jet engines.

How to INCREASE BOILER RATINGS with your present furnace and stack

Coppus-Dennis FANMIX Burners Give You More Heat with No Other Major Change in Equipment

Coppus-Dennis **FANMIX** Burners give you *perfect* mechanical mixing of fuel and air *at the burner outlet . . . instantaneous* ignition close to the burner . . . and *complete* combustion *without visible flame* when burning natural gas. No other burner combines these three advantages.

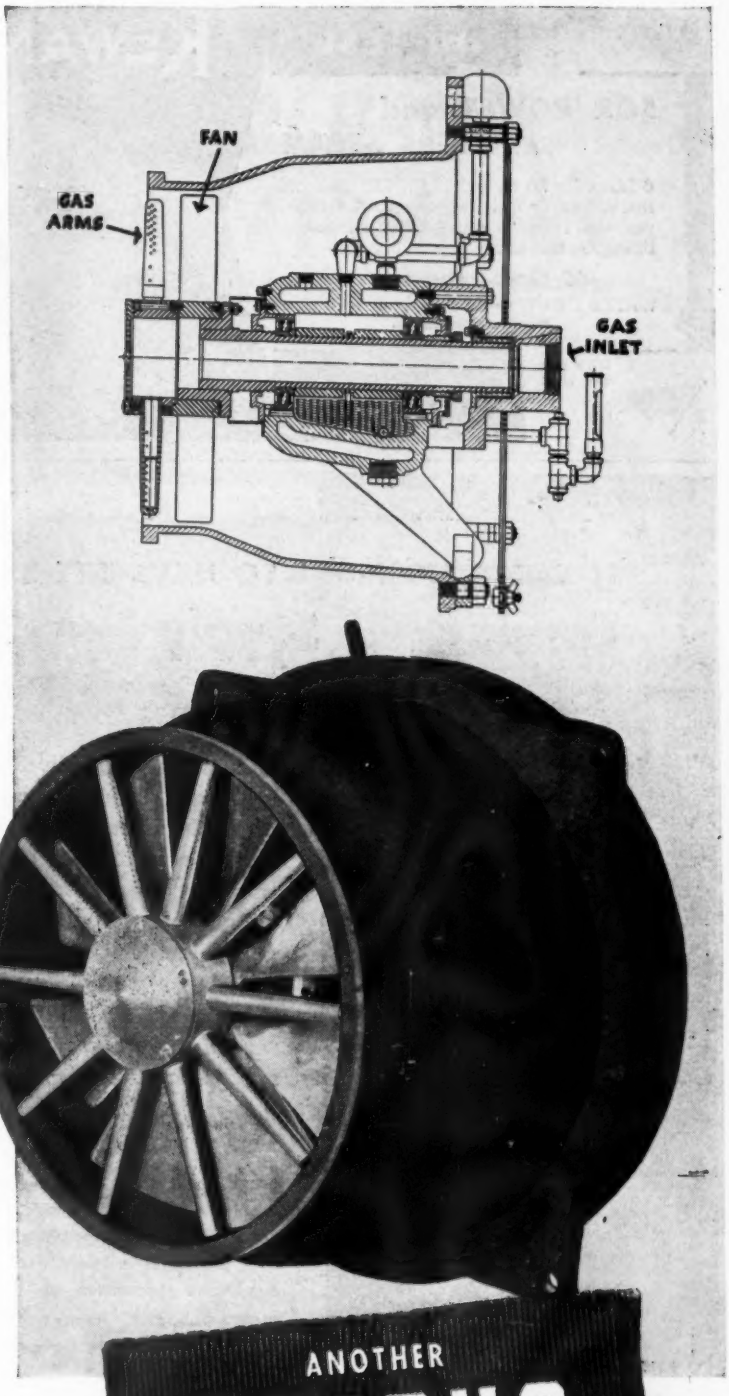
Because **FANMIX** delivers the *right* mixture of fuel and air *without blow-torch action*, all of your furnace space is used for combustion . . . *none for mixing*. That's why your present furnace can release more heat . . . why new installations can get more heat out of smaller furnace space.

Because **FANMIX** can be guaranteed to secure complete combustion of natural gas *with less than 5% excess air*, you get uniform "radiant heat" *without drifting hot spots*. That's why a **FANMIX**-fired furnace seldom varies in temperature more than 5% over its entire area.

WRITE FOR ALL THE FACTS

When you see in Bulletin 410–5 how fuel escaping from orifices in rotating driver arms rotates the fan to draw the correct proportion of air into the path of the fuel at right angles . . . how **FANMIX** creates its own forced draft, reduces stack requirements, prevents cracking of "wet" gas . . . how two **FANMIX** types handle either gas or oil or any combination of both — you'll understand why **FANMIX** Burners have such wide acceptance in oil refineries and power plants.

Send for the Coppus-Dennis **FANMIX** Bulletin 410–5. Coppus Engineering Corporation, Worcester 2, Mass. Sales Offices in THOMAS' REGISTER. Other Coppus "Blue Ribbon" products in BEST'S SAFETY DIRECTORY, CHEMICAL ENGINEERING CATALOG, and REFINERY CATALOG.



ANOTHER
COPPUS
"BLUE RIBBON" PRODUCT

COPPUS ENGINEERING CORP.
162 Park Ave., Worcester 2, Mass.
Please send Bulletin 410–5 to:

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Hi-Test KEWANEE

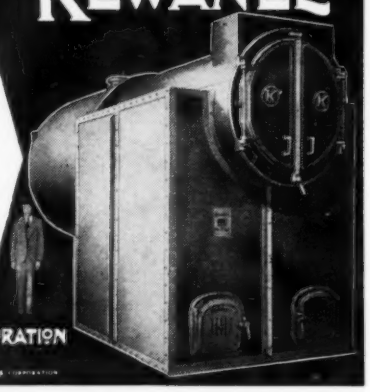
FOR POWER and PROCESS STEAM

6 Sizes for 50 to 150 H.P., 125 and 150 lbs. W.P.... a quick steaming, all-welded portable type with firebox for refractory lining. A fuel saver.

80 Years Boilermakers

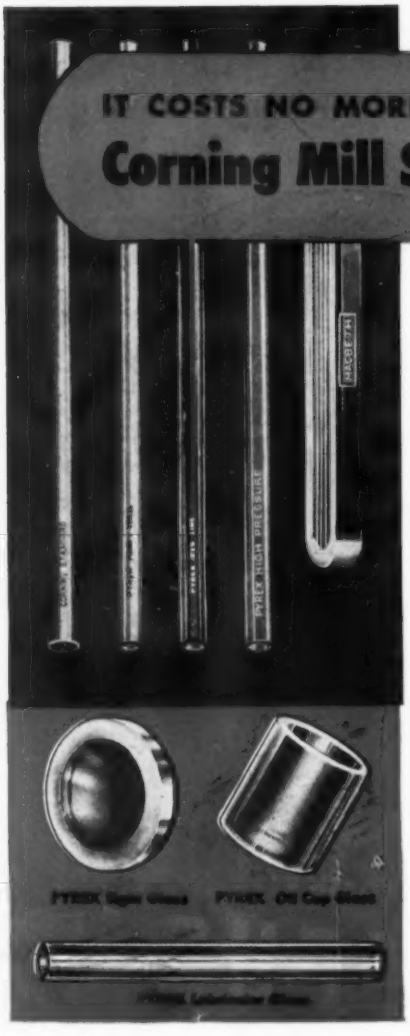
WRITE DEPT. 89-K2 for 6" scale with pipe diameter markings.

WON FOR 5th TIME



KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS
American Radiator & Standard Sanitary Corporation

IT COSTS NO MORE TO HAVE THE BEST . . .
Corning Mill Supply Glassware



The same glass that is used in making Corning's famous PYREX brand laboratory glassware goes into the manufacture of PYREX brand gauge glasses, sight glasses, oil cup and lubricator glasses. It is your positive assurance of top quaity. It means longer resistance to etching, staining, pitting and scratching. It means that their cost, service considered, is lowest.

A LINE THAT ANSWERS ALL REQUIREMENTS

GAUGE GLASSES: PYREX and CORNING brand tubular gauge glasses and MACBETH brand flat gauge glasses provide good visibility over prolonged periods, even under severe conditions (pressures up to 2,000 p.s.i.).

SIGHT GLASSES. PYREX brand sight glasses are made especially for ovens, absorption columns, reaction kettles, furnaces, pressure vessels, stills, tanks (pressures up to 300 p.s.i.) where safe internal visibility is necessary.

OIL CUP AND LUBRICATOR GLASSES: PYREX and CORNING brand glassware give you visibility plus long life on all types of machine operations.

Corning products are available from your nearest Mill Supplier . . . Call him today. Stock up. Be prepared for any emergency!

CORNING means research in GLASS

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CORNING GLASS WORKS, CORNING, N.Y.
SALES OFFICES: NEW YORK, CHICAGO, SAN FRANCISCO
PYREX GAUGE GLASSES
BRAND

TECHNICAL PRODUCTS DIVISION: GAUGE GLASSES • GLASS PIPE • LIGHTING WARE
SIGNALWARE • LABORATORY GLASSWARE • OPTICAL GLASS • GLASS COMPONENTS

Huge reinforced-concrete Ramapadasagar Dam on Godavari River in Madras Presidency in India will have a maximum height of 428 ft and a crest length of 6600 ft. It will require about 500,000 cu yd of rock excavation and 20-million cu yd of other excavation. The dam will create a reservoir covering 527 sq mi and will contain 8-million cu yd of concrete. The project is planned for power development, and other major benefits; six 33,000-kw turbines will be installed. Project will be completed in eight or nine years, with construction methods to require protection against high-flood discharges, the maximum possible flood being estimated at about 3,000,000 cfs.

Johns-Manville Corp recently unveiled the first big laboratory and pilot-plant building of the ultra-modern research center group it is erecting on banks of Raritan River, near Manville, N. J., and laid cornerstone of the second building, now under construction. This project will soon house the world's largest research laboratories devoted to building materials, insulations and allied industrial projects. Located on a 93-acre tract about 40 miles from New York, the new J-M research center will ultimately be composed of five or six buildings, connected by underground subways for trucking.

A super-bolt of lightning, believed to be the mightiest ever recorded, struck the University of Pittsburgh's Cathedral of Learning during the 1947 lightning season. Dr E L Harder, in charge of Westinghouse Electric Corp lightning research, said the stroke consisted of five separate surges, at least one of which contained an estimated 345,000 amp of electricity. The superbolt was trapped and recorded on special instruments installed as part of Westinghouse long-range research program, aimed at improving design of equipment to protect power lines, homes and factories.

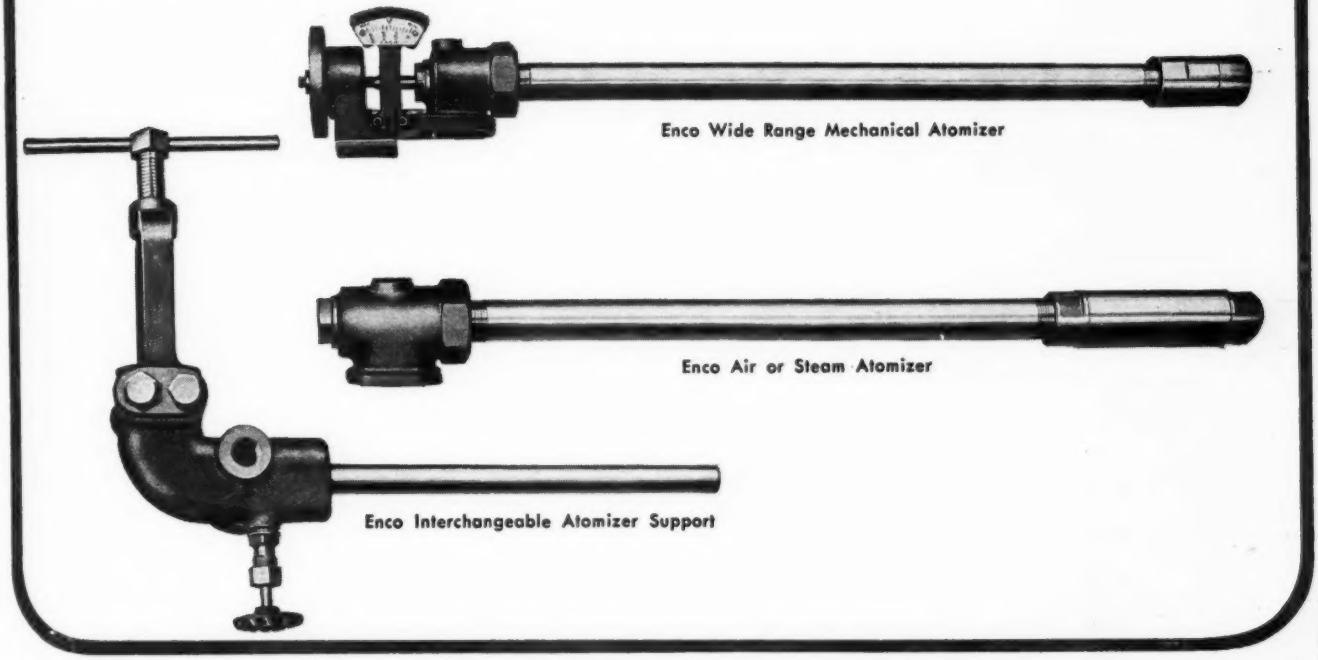
The stroke was far beyond the measuring capacity of all recording instruments mounted on the cathedral roof, with exception of a magnetic device and a photo recorder. Measurements and calculations indicate current, carried by mast and at least two of the guy wires, was about 115,000 amp apiece, or a total of 345,000 amp. Voltage could have been easily in the millions as experiments conducted later on the wooden guy spars required minimums of one-million volts to flash them over.

Most powerful lightning bolt previously recorded at the cathedral was 41,000 amp. For the entire nation the previous high was a 160,000-amp stroke registered in 1941 by an instrument mounted atop 585-ft smelter stack of Anaconda Copper Mining Co, Butte, Mont. Currents as high as 220,000 amp have been indicated for strokes to transmission lines but have not been measured accurately.

A H Timmerman, vice-president of Wagner Electric Corp, St. Louis, Mo., received a certificate for "fifty years of continuous service in the electrical industry" from National Electrical Manufacturers Assn at a meeting held in Atlantic City on Oct 29.

For Better Combustion Practice Use

ENCO INTERCHANGEABLE ATOMIZERS



Enco Wide Range Mechanical Atomizer

Enco Air or Steam Atomizer

Enco Interchangeable Atomizer Support

Interchangeable Enco Fuel Oil Atomizers are improving combustion practice in more and more progressive boiler rooms. Designed for exceptionally wide capacity ranges with all grades of liquid fuels, they eliminate burner tip changes, through the entire load range.

1. *Wide Range Mechanical Atomizers*—With a capacity range of 10 to 1—controlled manually at atomizer or automatically from remote station—*constant high oil pressure at atomizer insures efficient atomization over entire load range without recirculating or returning oil.*
2. *Steam or Air Atomizers*—Capacity range of 10 to 1—controlled by manual or automatic pressure regulation.

Both atomizers are designed to fit the Enco Interchangeable Atomizer Support. Enco Straight Mechanical Atomizers are also available.

Enco Fuel Oil Atomizers are built to give most economical, efficient service for any type pulverized coal, gas or oil-burning air register as well as for stoker-fired and industrial type furnaces. They can also be used independently for special applications.

The Engineer Company maintains a research and planning staff to help you improve your combustion practice. Literature completely describing any Enco product will be sent on request.

EC-473

THE ENGINEER COMPANY
ALSO PRODUCES:
Enco Air Registers
Enco Fuel Oil Pumping and Heating Units
Enco Automatic Oil-Electric Ignition Systems
Enco Automatic Combustion Controls
Enco Streamline Baffles

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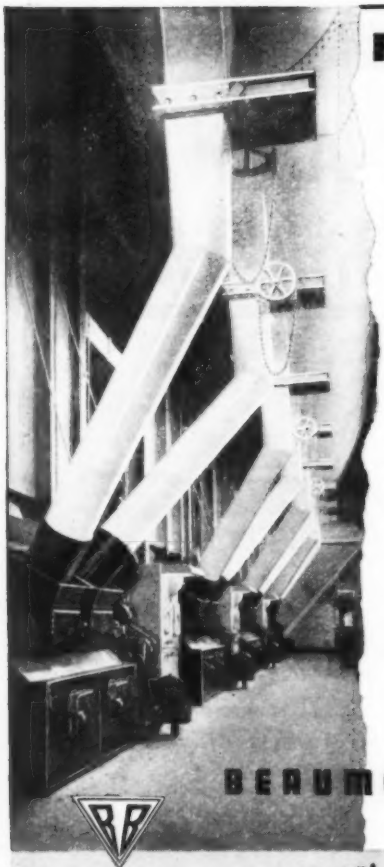


FOLLOW THE *Leader*

...and INSTALL BEAUMONT ANTI-FRICTION GATES

● Many utilities are replacing their present gates with Beaumont improved anti-friction type gates. Since the first order from one utility in 1942, many repeat orders have been received for installation in this company's other power plants.

In all cases, these gates have given very satisfactory service. According to one user, "No trouble whatever has been experienced opening and closing these gates—and no maintenance has been necessary other than periodic greasing".

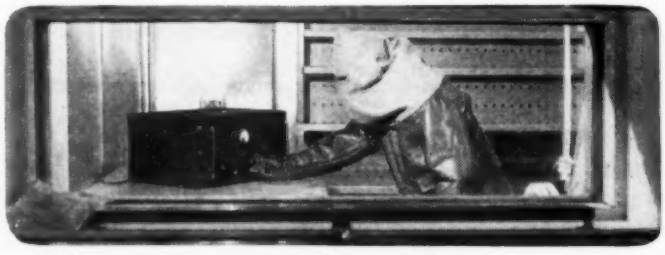
Many leading plants throughout the country are finding it economical and time-saving to install Beaumont trouble-free type gates such as those pictured at left. Follow the leaders and do the same. These gates are made in sizes from 14" to 30". Request complete information.

One contract—one responsibility

BEAUMONT BIRCH *Company*

1502 RACE STREET • PHILADELPHIA 2, PA.

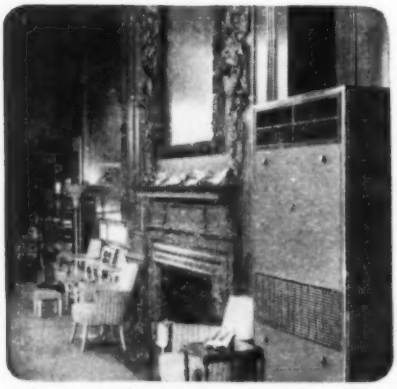
Designers Manufacturers Erectors COAL AND ASH HANDLING SYSTEMS



Testing a crystal frequency calibrator at 76° below zero in the Frick Refrigerated Laboratory of Bendix Radio, Towson, Md.

Hold Any Temperature You Want with

FRICK Refrigeration



This installation is among the thousands of stores, restaurants, hotels, clubs, theatres, offices, industrial plants, etc., which find Frick Air Conditioning indispensable.

"Cold" down to 130 degrees below zero F. is now common in research and test work. Penicillin is dried at minus 75. Foods are quick-frozen at minus 30 to minus 60; are stored at zero to minus 20. Ice is frozen commercially in brine at 16. Fresh foods are held at 34 to 36. Drinking water is cooled to 45. Air conditioning, at 70 to 85, tops the scale of refrigerating loads. ● Whatever the temperature wanted, you can hold it most dependably with Frick Refrigeration. Sixty-five years' experience says so!

DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

WAYNESBORO, PENNA. U.S.A.

General Electric Co introduces *Hevimet*, an alloy of tungsten, copper and nickel, to line of metallurgical products. The alloy possesses a density of 50% greater than lead and is applicable to design and construction of moving parts possessing maximum inertia and minimum size. Originally developed in response to demands for a material of high density for use on a gamma-ray screen, *Hevimet* is adaptable to construction of balance weights for elimination of vibration in crankshafts, modern air screws, centrifugal clutches and other rotating parts. Combining great tensile strength with good machinability, *Hevimet* is highly resistant to atmospheric salt-water corrosion and easily plated with cadmium, chromium and nickel. It may be silver soldered and brazed by standard methods.

Public Service Commission has authorized Central New York Power Corp to award contracts for new installations costing an estimated $1,661,933 at its Oswego generating station. The equipment, including a hydrogen-cooled turbine-generator and a power transformer, is necessary to meet postwar power-load requirements and to provide an adequate power reserve.

Carolina Power & Light plans construction of a new steam-electric generating plant three miles south of Lumberton, N. C., on Lumberton River. The plant, part of a $25,000,000 construction program, will have two 60,000-hp units that are expected to go into operation in 1950. The plant will be of outdoor construction, first of its kind in that section of the country. Generating units will operate at 1250 psi at 950 F. The plant will burn about 280,000 lb of coal per day. Carolina Power & Light now has eleven generating plants, nine of which are hydro.

James Slayter, vice-president in charge of research and development of Owens-Corning Fiberglas Corp, has been chosen to receive the 1948 Industrial Research Institute medal presented for outstanding contribution to field of industrial research.

Richard P Brown, chairman of board of Brown Instrument Co, Philadelphia, has been made a fellow of American Society of Mechanical Engineers. Brown was awarded recently an honorary degree of doctor of engineering by Drexel Institute of Technology.

Installation of first of three 1500-bhp Baldwin diesel units, to provide supplemental power for hydroelectric plant of Paul Smith's Electric Light and Power and Railroad Co of Saranac Lake, N. Y., has been completed at Piercefield in heart of the Adirondack region. The unit, an 8-cylinder supercharged engine with a generating capacity of 500 kw, built by Baldwin Locomotive Works at Eddystone, Pa., was rushed to completion this year because of fear of a drought that failed to materialize. The other two units, both 1500-bhp supercharged that will generate 1000 kw each, are scheduled to be installed by next April, before the summer-resort season opens.

How Timken bearings boost booster precision

IN the new Hydro-Power® oil hydraulic booster (used to convert low pressure to high pressure), close clearance between the central valve and main body is essential to guard the pressure differential between the high and low pressure sides. How to maintain such precision? Timken tapered roller bearings on the central valve shaft.

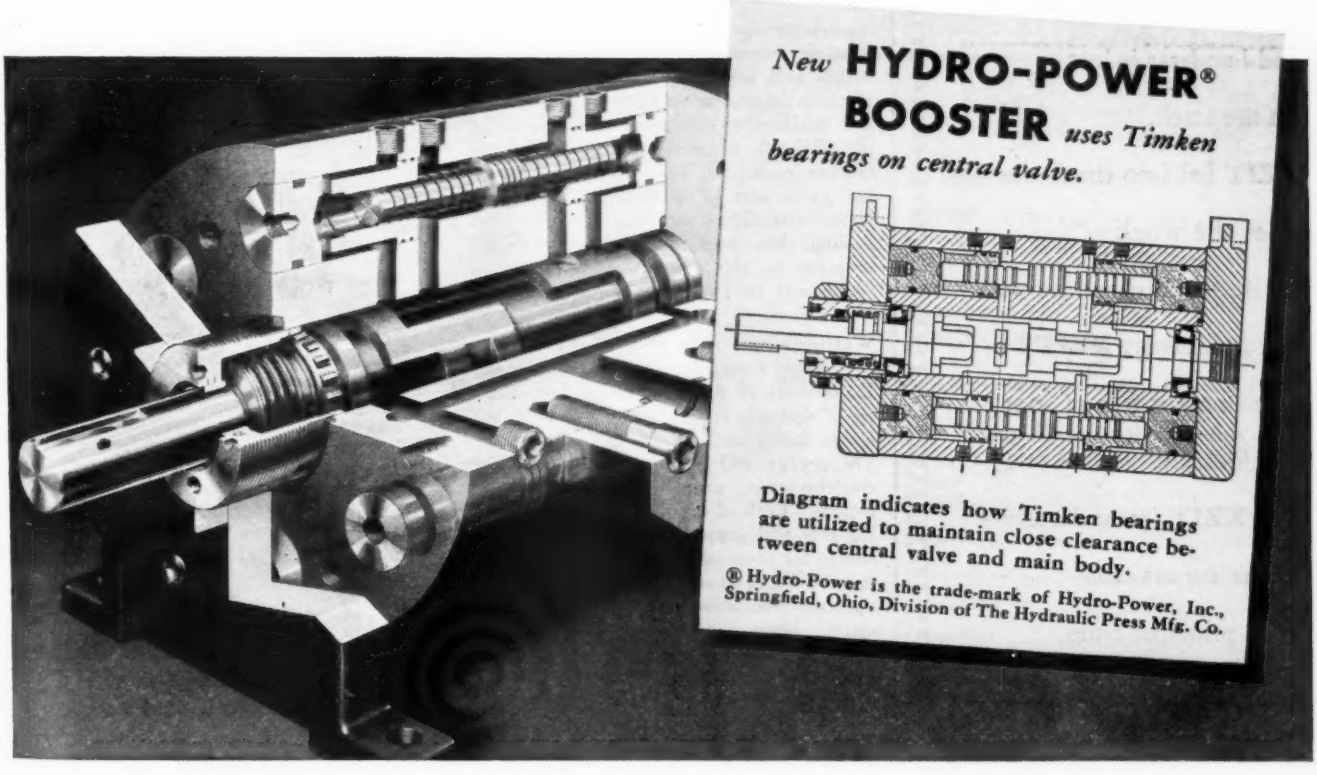
Timken roller bearings assure precision because they are precision products themselves. They are manufactured to exactingly close tolerances—finished to incredible smoothness. And they retain their precision because of the Timken fine alloy steel of which they are made.

Maximum support for shafts is provided by the line contact between rolls and races. The tapered construction of Timken bearings permits accurate preloading and close adjustment to retain precision indefinitely.

If you're looking for a way to maintain positive clearances between moving parts, make sure the trade-mark "Timken" is on every bearing you use. Only Timken bearings can give you *all* their advantages. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN BEARING EQUIPPED

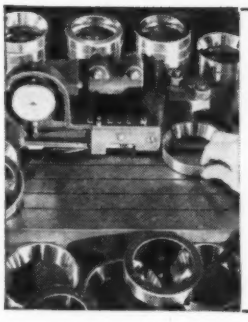
This symbol on a product means its bearings are the best.



New **HYDRO-POWER® BOOSTER** *uses Timken bearings on central valve.*

Diagram indicates how Timken bearings are utilized to maintain close clearance between central valve and main body.

® Hydro-Power is the trade-mark of Hydro-Power, Inc., Springfield, Ohio, Division of The Hydraulic Press Mfg. Co.



WITHIN ONE HALF A THOUSANDTH OF AN INCH!

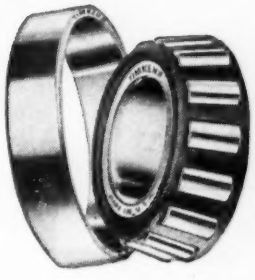
. . . that's an example of the accuracy demanded in the outside diameter of Timken bearing cups in order to pass inspection.

The Timken Company is the acknowledged leader in: 1. advanced design; 2. precision manufacture; 3. rigid quality control; 4. special analysis Timken steels.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◐ AND THRUST ◐ LOADS OR ANY COMBINATION ✳

PROVE XZIT

in your own boiler!

XZIT saves fuel

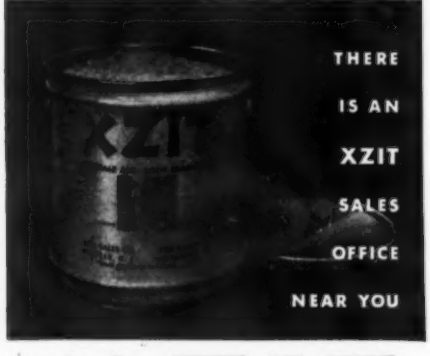
by removing soot and firescale from all surfaces of the boiler —the tubes, uptakes & stack.

Stack temperatures, before and after using **XZIT**, definitely show that **heat transfer is improved** and less heat is lost up the stack.

XZIT fed into the flame **does the work while the boiler operates.**

Used regularly, **XZIT** keeps boilers free of soot and firescale.

Try XZIT immediately-- stocks are available in all principal cities.



XZIT

FIRESCALE & SOOT ERADICATOR

5800 S. Hoover St., Los Angeles, Calif.

158 14th St., Hoboken, New Jersey

American Brake Shoe Company's two new nonferrous foundries recently completed at Niles, Ohio, and Meadville, Pa., were opened Dec 8 and 9, respectively, according to an announcement by Thomas W Pettus, president of National Bearing Div. The new Meadville plant, replacing an older plant of the div formerly located there, will produce bronze bearings and castings. It will specialize in copper, brass and bronze for railroads, steel mills and many other industries, and in precision machine bearings for diesel engines and other high-speed and heavy-duty service. New foundry at Niles, Ohio, will manufacture railroad journal bearings. James Stewart & Co constructed the Niles plant and Ragnar Benson, Inc, the Meadville plant.

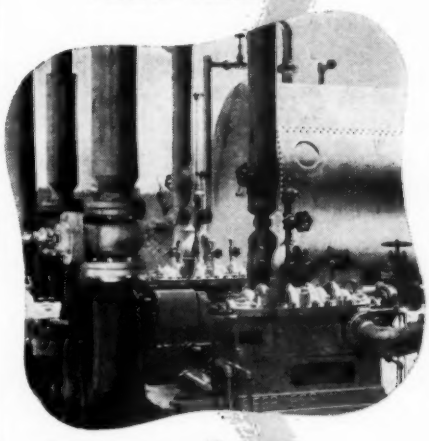
Linde Air Products Co, unit of Union Carbide & Carbon Corp, has announced that construction will start soon on an oxygen filling station and acetylene-producing plant at Little Rock, Ark. The plans include a warehouse for distribution of carbide.

American Society of Heating and Ventilating committee on heat distribution within and behind the panel met at the research laboratory in Cleveland on Nov 5 and initiated specific recommendations for the society's planned program of panel-heating research. The committee, operating as a part of ASHVE technical advisory committee on panel heating and cooling, has presented its recommended program to the committee on research, which met in Dec.

Westinghouse Electric Corp has disclosed that a seagoing dredge, which strips 12,000 tons of dirt and muck from navigable channels in two hours, will soon take up its duties for U. S. Corps of Engineers. The dredge will be a twin-screw turbine-electric vessel, propelled by two 4000-hp motors. Each of the main turbine-generating sets will supply 3300 kw of electrical energy for propulsion, 1600 kw for dredging and 500 kw of auxiliary power for winches, lighting, ventilation fans and other equipment. Main condensers will have 5500 sq ft of surface area. The ship itself is being constructed by Sun Shipbuilding and Dry Dock Co, Chester, Pa.

Wells N Thompson, project director and vice-president of H K Ferguson Co, industrial engineers and builders of Cleveland, New York and Houston, has announced names of five men who are playing key roles in construction of first peacetime nuclear reactor (atomic pile) at Brookhaven National Laboratory. The nuclear reactor was started in early August and construction is now well under way. Completion of the pile building is expected next fall. Thompson's principal aides in the engineering and construction program are: Frank W Buck, chief engineer; S C Willis, general superintendent in charge of construction; Norvon Clark, personnel manager in charge of employment, labor relations and security; T W Ryan, comptroller; and Dennis L Ryan, assistant to project director.

ALL ALONG THE LINE THERE'S A PEERLESS PUMP TO MEET YOUR NEED



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TYPE TUT

Multi-Stage Pumps for Boiler Feed Service

High efficiency is inherent in the design of the Peerless Type TUT Pumps. Built for heavy duty service the multi-stage TUT assures dependable operation in boiler feed water service as shown or in pumping other fluids in capacities up to 2500 g.p.m. against heads from 250 to 1000 feet. All types of drives available. Range of horsepower: 20 to 400 h.p.

FOR PUMPING CAUSTICS AND ACIDS ASK ABOUT PEERLESS TYPE ACO PROCESS PUMPS

Improved design has many advanced features for cutting corrosives pumping costs. Handles up to 800 g.p.m. against heads to 100 lbs.

REQUEST DESCRIPTIVE LITERATURE

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PEERLESS PUMP DIVISION

Food Machinery Corporation

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Reader Service Page for . . .

NEW EQUIPMENT and TECHNICAL LITERATURE

Use the handy FREE service cards for additional information on this month's new products or for copies of latest trade catalogs.

NEW PRODUCTS & MATERIALS

See pages 118-122, 154-168

Electronic Speed Control.....page 118
Transformer Release .....page 118
Test Instrument .....page 118
Cooling Tower .....page 118
Ball Valve .....page 118
Malleable Brazed Fitting.....page 118
Pressure Gages .....page 120
Electric Welder .....page 120
Trip-Proof Coupling .....page 120
Compressor Control .....page 120
Booster Fan .....page 120
Ac Voltage Recorder.....page 120
Gate Valve .....page 120
Plug-In Panelboard .....page 120
Position Recorder .....page 122
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MANUFACTURERS' BULLETINS

See pages 178b-184

Boilers and Auxiliaries .....page 178b
Electric Equipment .....page 178b
Maintenance and Safety Equipment .....page 178b
Materials Handling .....page 178b

(Turn over for bulletin items)

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Be sure to fill out, completely, one coupon for each item of information you order. (See sample, right.) This gives your request authority and helps the manufacturer to address your copy completely.

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Meters and Instruments, Mechanical ..... page 180
Piping, Fittings, Valves and Specialties ..... page 182
Pumps ..... page 182
Water Treatment ..... page 184
Welding ..... page 184
Other Equipment ..... page 184

BOILERS AND AUXILIARIES

1 SPREADER STOKER—Detroit Stoker Co, General Motors Bldg, Detroit, Mich. 40-page catalog No. 60 describes the Detroit RotoGrate stoker. Typical examples of various installations are shown with a wide range of boiler types and sizes.

2 INSULATED REFRACTORY BACKING—Geo P Reintjes Co, 2517 Jefferson St, Kansas City 10 Mo. Bulletin No. 947 discusses a flexible, unit-supported, insulated refractory backing for close-spaced water walls. Diagrams are included.

3 BOILER AND TANK ACCESSORIES—Steel Improvement & Forge Co, 970 E. 64th St, Cleveland 14, Ohio. 20-page catalog No. 11 on forged boiler and tank accessories gives complete buying information on manhole and handhole plates and yokes.

ELECTRICAL EQUIPMENT

4 AC CONTACTORS—Ward Leonard Electric Co, 31 South St, Mt. Vernon, N. Y. 4-page bulletin No. 4451 covers application and construction of Size 1 ac solenoid contactors. Ratings and dimensions are given.

5 HIGH-FREQUENCY CONDUCTOR—Titeflex, Inc, 500 Frelinghuysen Ave, Newark 5, N. J. Folder describes Titeflex water-cooled, flexible leads for use in conducting high-frequency currents.

6 AC GENERATORS — Electric Machinery Mfg Co, 821 Second Ave S E, Minneapolis 14, Minn. 16-page booklet, Vol. 8, No. 3a, tells about the new packaged Regulectric ac generator. Photos, diagrams and tables are included.

7 HIGH-CURRENT RESISTORS — Ward Leonard Electric Co, 31 South St, Mt. Vernon, N. Y. 8-page bulletin No. 35 presents Ward Leonard Barohm, Loopohm and Edgeohm resistors. Resistance values, current-carrying capacities, dimensions, methods of mounting, etc, are given.

8 SQUIRREL-CAGE INDUCTION MOTORS—Louis Allis Co, Milwaukee 7, Wis. 16-page bulletin No. 516-D gives electrical and mechanical features of CT rolled shell, shaftless squirrel-cage induction motors for built-in drives.

9 SAFETY CORD SWIVEL—Burlington Instrument Co, Burlington, Iowa. 4-page bulletin discusses Burlington safety cord swivel that prevents twisting, curling and dangerous knots in electrical appliance and hand tool cords.

10 AXIAL AIR-GAP MOTOR — Fairbanks, Morse & Co, 600 S Michigan Ave, Chicago 5, Ill. 16-page bulletin No. 2760 covers design and construction of Fairbanks-Morse axial air-gap motor. Applications, dimensions and sizes are discussed.

MAINTENANCE AND SAFETY EQUIPMENT

11 WIDE BELT CUTTER — Flexible Steel Lacing Co, 4607 Lexington St, Chicago 44, Ill. Bulletin No. BC350 covers the Alligator wide belt cutter. Parts and list prices are included.

12 SOLDERING IRONS — Hexacon Electric Co, 161 W Clay Ave, Roselle Park, N. J. Form No. 142 discusses Hexacon line of soldering irons. Typical applications are given.

13 MULTIPLE OILERS — Gits Bros Mfg Co, 1846 S Kilbourn Ave, Chicago, Ill. Single sheets describe three oiling systems developed by Gits. Photos, diagrams and tables are shown.

MATERIALS HANDLING

14 SELF-FEEDING CONVEYOR — Link-Belt Co, 307 N. Michigan Ave, Chicago 1, Ill. Bulletin No. 2175 presents the Link-Belt Bulk-Flo conveyor for mechanical handling of a great variety of bulk flowable granular, crushed, ground or pulverized materials of a nonabrasive, noncorrosive nature.

15 BELT CONVEYORS—Jeffrey Mfg Co, Columbus 16, Ohio. 160-page catalog No. 786 provides a complete selection of Jeffrey standardized belt conveyors. In addition, there is listed a complete line of antifriction idlers in cast iron or steel, to meet any service requirement.

16 ELEVATOR ACCESSORIES — Otis Elevator Co, 260 11th Ave, New York 1, N. Y. Bulletin No. B-658 discusses the Otis direction indicator for use in cars of collective control elevators. Bulletin No. B-659 covers Otis car position indicator, which is installed in elevator car over the entrance. Bulletin No. B-660 presents Otis hall position indicator, installed over hoistway entrance.

17 TRUCKS AND CRANES — Lewis-Shepard Products Inc, 290 Walnut St, Watertown 72, Mass. 86-page catalog No. 23 describes fork trucks, lift trucks, floor truck, cranes, etc. This catalog contains photographs of each type of equipment.

18 BELT CONVEYOR SYSTEM—Robins Conveyors Div, Hewitt-Robins Inc, Passaic, N. J. Bulletin No. 120-A1 gives information necessary for laying out a belt conveyor system. Bulletin also points out features of Robins Idlers, such as one-shot lubrication, triple grease seal, rigid truss construction, malleable iron brackets, etc.

19 TORQUE CONVERTER TRACTOR —Tractor div, Allis-Chalmers Mfg Co, Milwaukee, Wis. 6-page folder describes new HD-19 torque converter tractor. A full page of specifications gives engine construction, steering design, speeds and drawbar pull.

20 ELEVATOR ENTRANCES — Dahlstrom Metallic Door Co, Jamestown, N. Y. Bulletins No. B-687, B-691, B-692, B-693, B-694 and B-695 discuss single-

(*Continued on page* 180)

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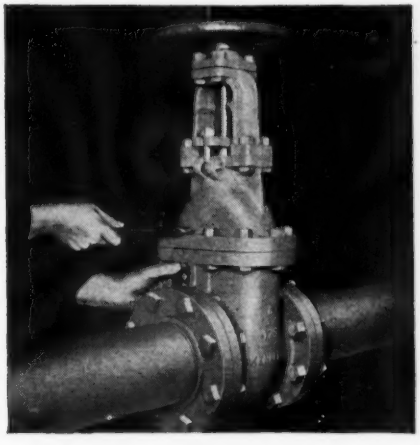
MAINTENANCE IS EASY
when you use Kennedy Valves

Kennedy Valves are designed for easy maintenance. This Kennedy Iron-Body Wedge Gate Valve, for example, is easy to lubricate. A conveniently-located oil hole is provided in the yoke cap . . . accessible even when the valve is closed.

Repacking the gland is easy, too. Gland bolts need only be loosened and swung out, and the packing gland lifted on the stem and rested on shelves inside the yoke, out of the way. It may be packed under pressure when valve is wide open.



All bolts on body, yoke and flanges are readily accessible, with ample room for swinging the wrench. Nuts are on top of the yoke flange—not underneath. Gland bolts have washer nuts to eliminate the nuisance of loose washers.

On screwed end valves, lugs are provided around the outside of the end connections for convenience in applying a pipe or chain wrench.

Operation of the valve, too, is easy. The large-diameter hand-wheel provides ample leverage for effortless opening and closing of the valve.

The Kennedy Iron-Body Wedge Gate Valve is only one of hundreds of Kennedy Valves, all designed for minimum maintenance, easy operation, and long service life. For details see Kennedy's 240-page Catalog.

THE KENNEDY VALVE MFG. CO., ELMIRA, NEW YORK
Offices and Warehouses in Principal Cities

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KENNEDY valves - pipe fittings - fire hydrants

It is impossible to design a plant that can still be called "modern" twenty years after it is built . . . *but* designs that call for the best and most modern equipment of today obviously stand a better chance of being at least "good" after twenty years of use.

Installation of S. E. Co. Conical Distributors, Coal Scales and Coal Valves will fully assure that your "Bunker-to-Stoker" and "Bunker-to-Pulverizer" design is the last word in engineering excellence *and* that this equipment will function with equal dependability during its entire period of use.

Write for bulletins on STOCK-engineered "Bunker-to-Stoker" and "Bunker-to-Pulverizer" installations. Address STOCK ENGINEERING COMPANY, 715 Hanna Bldg., Cleveland 15 Ohio.

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★ CONICAL
Non-Segregating
Coal Distributors
★
S.E.CO.
Coal Valves and Coal Scales

swing elevator entrances, single-slide elevator entrances, center-opening elevator entrances, 2-speed elevator entrances and flush doors.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **VIBRATORY MATERIAL - HANDLING EQUIPMENT**—Syntron Co, 492 Lexington, Homer City, Pa. 92-page catalog covers electromagnetic vibrators, packers, vibratory feeders, dry feeder machines, weighing feeders, mechanical shaft seals, etc. Construction and maintenance tools are also described.

21 SINGLE SWING-DOOR ELEVATOR ENTRANCES—Art Metal Construction Co, Jamestown, N. Y. 6-page bulletin No. B-688 gives specifications of Art Metal single swing-door elevator entrances Photos and diagrams are included.

22 SWING ELEVATOR ENTRANCES—Jamestown Metal Corp, Jamestown, N. Y. Bulletin No. 689 discusses specifications for Jamestown swing elevator entrances.

23 PLATFORM SCALES — Yale & Towne Mfg Co, 4530 Tacony St, Philadelphia 24, Pa. 16-page bulletin No. P714C presents the new Load King dormant platform scale. Four charts give scale dimensions, platform sizes, scale capacities, dial graduations, tare beam capacities, beam capacities and shipping weight for self-contained and semi-self-contained dormant platform scales.

MECHANICAL TRANSMISSION

24 WORM GEAR SPEED REDUCERS—Cleveland Worm & Gear Co, 3293 E 80th St, Cleveland 4, Ohio. 8-page catalog No. 300, entitled "Proof of the Pudding," presents a few installations of fan-cooled Speedaire unit.

25 POWER TRANSMISSION EQUIPMENT—Falk Corp, 3001 W Canal St, Milwaukee 8, Wis. 12-page bulletin No. 10,000 contains descriptions of gears, speed reducers, Motorducers, couplings, high-speed drives, backstops, marine drives, special gear drives, etc.

26 V-BELTS—Mechanical Goods Div, U. S. Rubber Co, 1230 Avenue of the Americas, New York 20, N. Y. V-belt catalog covers comparison tables, selection data and other detailed information on V-belts.

27 FAN-COOLED SPEED REDUCERS—Cone-Drive div, Michigan Tool Co, 7171 E McNichols Rd, Detroit 12, Mich. 4-page technical bulletin (data sheet No. 8974) describes operation of Cone-Drive fan-cooled speed reducers. Tables show combined mechanical and thermal ratings.

METERS AND INSTRUMENTS, MECHANICAL

28 BEARING TEMPERATURE MONITOR—Instrument div, Thomas A Edison, Inc, West Orange, N. J. 12-page bulletin No. 3012 discusses operation of Edison critical temperature monitor. Advantages of this monitor are given.

29 VISCOSITY MEASUREMENT INSTRUMENT—Dept 6G-H, Fischer & Porter Co, Hatboro, Pa. 4-page bulletin No. 88 covers construction of Fischer & Porter viscorator continuous viscosimeter. Capacities and dimensions are given.

30 THERMOCOUPLE AND PYROMETER ACCESSORIES — Bristol Co, Waterbury 91, Conn. Bulletin No. P1235 discusses thermocouples, protection tubes and pyrometer accessories. It contains a chart and engineering data on selecting right thermocouple and protection tube.

31 ROTAMETER TUBE — Schutte & Koerting Co, 12th & Thompson St, Philadelphia 22, Pa. Bulletin sheet No. 18-R3 gives a complete description of HCF tube for SK Rotameters.

32 ORIFICE FLOWMETER—American District Steam Co, North Tonawanda, N. Y. 12-page bulletin No. 35-83A de-

Automatically Cleans Tubes Without Efficiency Dropping

The C. H. Wheeler Patented Reverse Flow Condenser automatically cleans its tubes and tube sheets periodically without a drop in operating efficiency. Black arrows below indicate one in-and-out flow, while white arrows indicate the reverse. Changes in flow direction are effected in a few moments, thus there is no drop in the condenser operating efficiency. This design is particularly suitable where circulating water contains leaves or other trash. Note simplified piping inlet and outlet connections. The Reverse Flow is only one type in our complete line of Dual Bank Surface Condensers, described in our Catalog 1461. Write for it today.

C. H. WHEELER MFG. CO.
1800 Sedgley Avenue, Philadelphia 32, Pa.
REPRESENTATIVES IN MOST PRINCIPAL CITIES

Photos show Non-Divided Water Box Type. Divided Water Box Type available.

Black Arrows show circulating water entering First Pass at bottom of condenser and returning through Second Pass at top, then out. White Arrows show reverse flow, Second Pass becomes First Pass and First Pass becomes Second.

C. H. Wheeler

STEAM CONDENSERS · AIR EJECTORS
COOLING TOWERS · HEAT EXCHANGERS
OF PHILADELPHIA

Nicholson Expansion Steam Traps are

FREEZE-PROOF

RESISTANT TO TEMPERATURE VARIATION

Among the features of this simple and widely adaptable trap is its positive action. Closes tight when steam is in trap, opens wide when cold, rendering it freeze-proof. The ease with which it maintains adjustment under extreme variations in surrounding air is another trouble-proof feature.

Pressure: 0 to 250 lbs. without change of valve or seat.
Length: 18" to 40". 2 types: thermostatic, continuous flow.

Easily Installed - Easily Adjusted - Low Cost

Entirely automatic; only one moving part. Adjustable valve for passing condensate at any desired temperature. Low cost, making unit trapping practical. Usually installed without support. Also a complete line of weight and piston operated traps for steam, air, gasoline, pressures to 1500 lbs.; thermostatic steam traps, pressures to 225 lbs. Catalog 444 or see Sweet's.

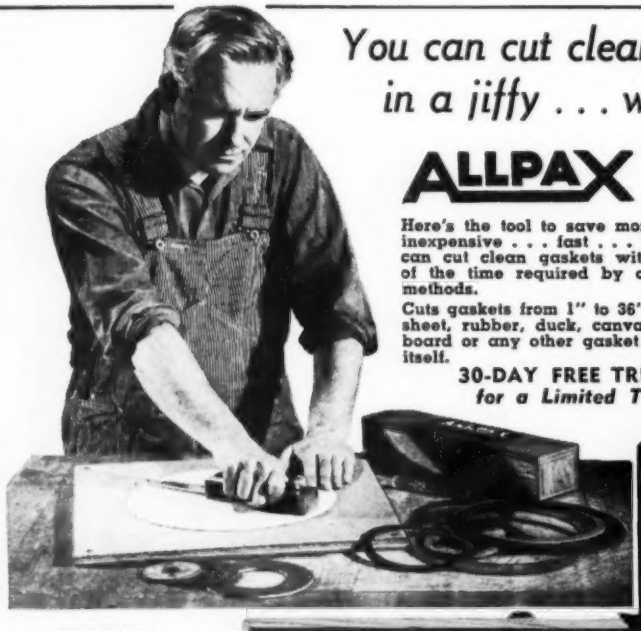
W. H. NICHOLSON & CO.

125 OREGON STREET, WILKES-BARRE, PA.

Manufacturers of Steam Specialties for Over 75 Years

You can cut clean gaskets in a jiffy . . . with the

ALLPAX GASKET CUTTER



Here's the tool to save money and time . . . inexpensive . . . fast . . . foolproof. Anyone can cut clean gaskets with it in a fraction of the time required by old-fashioned hand methods.

Cuts gaskets from 1" to 36" diam. in asbestos sheet, rubber, duck, canvas, cork, felt, cardboard or any other gasket material. Pays for itself.

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scribes Adsco flowmeter of orifice design for indicating, recording and integrating flow of steam, gas and air.

33 INDICATING RECORDERS AND CONTROLLERS—Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia 44, Pa. 16-page catalog presents specifications for automatic indicating recorders, and indicating and recording controllers.

34 CONDUCTIVITY MEASUREMENTS—Industrial Instruments, Inc, 17 Pollock Ave, Jersey City 5, N. J. Bulletin, entitled "Conductivity Measurements in Boiler Operation," describes manual and automatic equipment for measuring electrolytic conductivity of condensed steam, boiler water, raw water and return condensate.

35 THICKNESS GAGE—Scott Electroflux Co, 400 Main St, Waltham 54, Mass. 4-page booklet discusses Electroflux thickness gage for nondestructive measuring of corrosion and wall thickness.

36 PLASTIC-TUBE MANOMETERS—F W Dwyer Mfg Co, 317 S Western Ave, Chicago 12, Ill. Bulletin No. 171 presents Dwyer Flex-Tube manometers for providing accurate pressure, vacuum or differential readings.

37 HOOK GAGE—F W Dwyer Mfg Co, 317 S Western Ave, Chicago 12, Ill. Bulletin No. 176 discusses a transparent hook gage for low-pressure and vacuum measurements.

PIPING, FITTINGS VALVES AND SPECIALTIES

38 STEAM TRAP—Coe Mfg Co, Painesville, Ohio. 20-page catalog No. 903B gives operation of the Coe Drainator, a continuous flow steam trap. Applications are included.

39 INDUSTRIAL FLOATS—Dept N, Chicago Float Works, Inc, 2330 Western Ave, Chicago 8, Ill. 20-page catalog describes complete line of copper, steel, monel and stainless-steel industrial floats.

40 WELDING FITTINGS—Stainless Alloy Div, Pittsburgh Piping & Equipment Co, 10 43rd St, Pittsburgh, Pa. Catalog No. S-309 gives complete specifications and list prices of 2824 stock items in stainless-steel Types 304, 316 and 347 welding fittings.

41 BLEEDER LINE PROTECTING VALVES—Schutte & Koerting Co, 12th & Thompson St, Philadelphia 22, Pa. 24-page bulletin No. 8K covers bleeder line protecting valves. Drawings and text describe valves and their operation.

42 SAFETY AND RELIEF VALVES—Farris Engrg Corp, 453 Commercial Ave, Palisades Park, N. J. 6-page condensed specifications bulletin No. 50 facilitates prompt selection of relief or safety valves by an index. This listing gives all type numbers and other pertinent data, together with comparison numbers of other commonly used valves.

43 PIPE SUPPORT—Pipe Suspension Div, C H Leibfried Mfg Corp, 97 Guernsey St, Brooklyn 22, N. Y. 4-page catalog No. 316 gives design and installation of Leibfried Redtop pipe support. Tables show supporting load, dimensions, net weight and list prices.

44 GATE VALVE—Jenkins Bros, 80 White St, New York 13, N. Y. 12-page folder describes new Fig. 270-U bronze gate valve with Monel seat rings. Folder also discusses Jenkins complete line of 34 other bronze gate valves with pressure ratings and size ranges.

45 CORROSION-RESISTANT Y AND ANGLE VALVES—Duriron Co, Dayton 1, Ohio. 4-page bulletin No. 615 covers Durco corrosion-resistant Series 35 Y valves and Series 36 angle valves. Cutaway views show internal construction.

PUMPS

46 CENTRIFUGAL PUMPS—Warren Steam Pump Co, Warren, Mass. 6-page bulletin No. 241, revised, discusses Warren 4- and 6-stage Type TM centrifugal pumps. Bulletin information includes exterior and sectional views, special mechanical features, metal specifications and composite dimensions.

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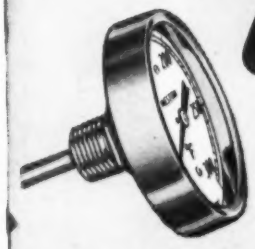

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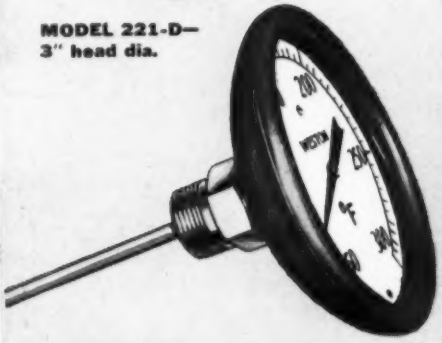
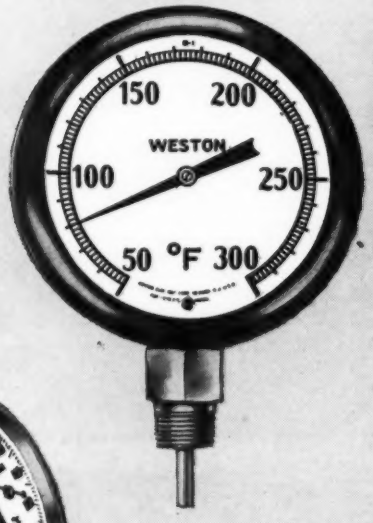
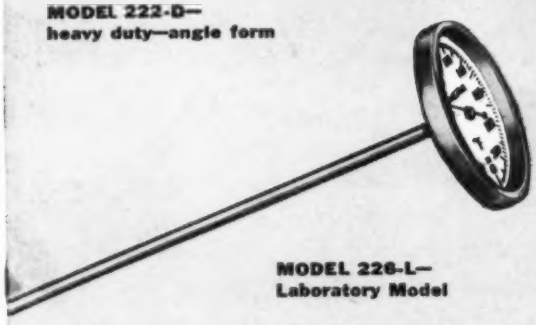
3" head dia.



MODEL 222-D—
heavy duty—angle form



MODEL 122-D—
heavy duty—
straight form



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47 **PUMPS AND CONDENSATE RETURN UNITS**—Roy E Roth Co, 2420 4th Ave, Rock Island, Ill. 4-page bulletin No. 1-1 describes construction and application of turbine pumps. Features of these pumps are included. 4-page bulletin No. 1-6 and 8-page bulletin No. 1-7 give a complete story of Roth commercial pumping units and their assembly into condensate return units.

48 **HIGH-PRESSURE PUMPS**—Warren Steam Pump Co, Warren, Mass. 6-page bulletin No. 244 covers Type TH 6-stage high-pressure pumps for boiler pressures to 1200 psi. External and large sectional views illustrate construction features.

49 **SELF-PRIMING PUMP** — Allis-Chalmers Mfg Co, Milwaukee 1, Wis. 8-page bulletin No. O8B6319B discusses design and construction of Allis-Chalmers' automatic self-priming pump. Applications and specifications are given.

WATER TREATMENT

50 **BOILER WATER CONDITIONING** —E F Drew & Co, 15 E 26th St, New York 10, N. Y. 8-page booklet describes treatments and services furnished under Drew system of boiler water conditioning to prevent scale, sludge, corrosion and carryover in boilers.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **WATER CONDITIONING** — Liquid Conditioning Corp, 114 E Price St, Linden, N. J. 60-page bulletin No. G-1 discusses methods and apparatus for conditioning water and other liquids.

51 **CHEMICAL SOLUTION FEEDERS** —Infilco Inc, 325 W 25th Pl, Chicago 16, Ill. 4-page bulletin No. 305-A gives advantages, specifications, and applications of Type COE chemical solution feeders.

52 **BOILER WATER LEVEL CONTROL** — Northern Equipment Co, Erie, Pa. 8-page bulletin No. 473, entitled "Boiler Water Level Control at the Municipal Power Plant, City of Monroe, Louisiana," gives a thorough description of boiler water control at this plant.

WELDING

53 **ARC WELDERS**—Hobart Brothers Co, Hobart Sq, Troy, Ohio. 36-page catalog contains descriptions, dimensions and specifications on complete line of arc welders. Also listed is complete line of Hobart arc-welding electrodes and accessories.

54 **OXYGEN CUTTING OF STEEL**— Dept 1638P, Air Reduction Sales Co, 60 E 42nd St, New York 17, N. Y. 12-page reprint, entitled "Oxygen Cutting of Steel at Elevated Temperatures," by J F Kiernan and J S Sohn, covers the subject thoroughly. It contains useful data that has been derived from over 3000 controlled cutting tests.

55 **ARC WELDING**—Dept 1632, Air Reduction Sales Co, 60 E 42nd St, New York 17, N. Y. 8-page folder describes three types of Heliweld equipment. These are the manual holder, machine holder and electronically controlled automatic head.

56 **ARC WELDERS**—Hobart Brothers Co, Hobart Sq, Troy, Ohio. Folder No. DM768 discusses Hobart ac transformer arc welders. Photographs are included.

OTHER EQUIPMENT

57 **APRONS AND SLEEVES**—Industrial Products Co, 2820 N 4th St, Philadelphia 33, Pa. 4-page folder gives weights, sizes and prices of IPCO Nitroflex aprons and sleeves.

58 **GAGE LABORATORY**—Armour Research Foundation, Illinois Institute of Technology, Technology Center, Chicago 16, Ill. 16-page booklet discusses

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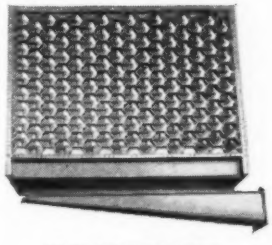

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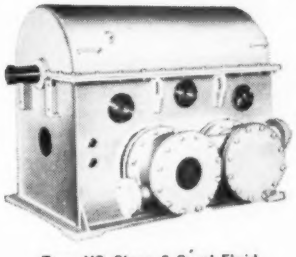
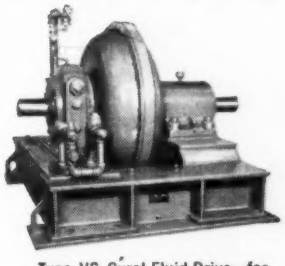
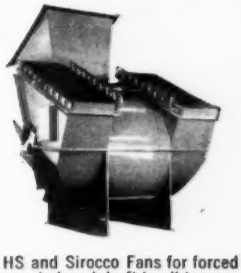


Type VS Class 6 Gyrol Fluid Drive—for adjustable speed control of boiler feed pumps.



Type VS Gyrol Fluid Drive—for adjustable speed control of mechanical draft fans.



HS and Sirocco Fans for forced or induced draft in all types of power plants.

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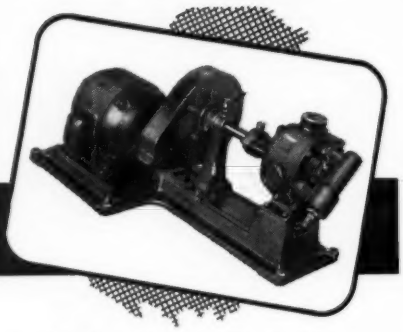

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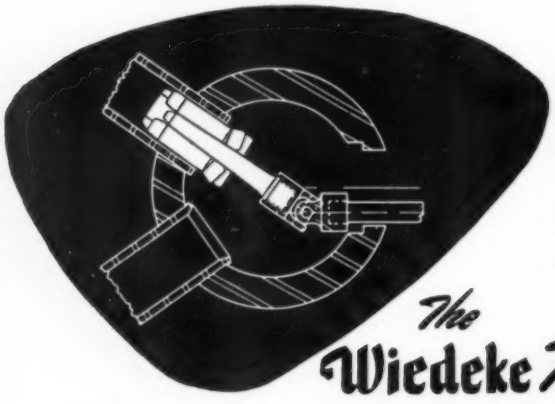

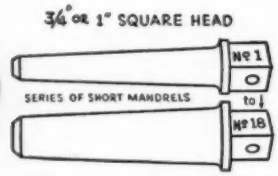

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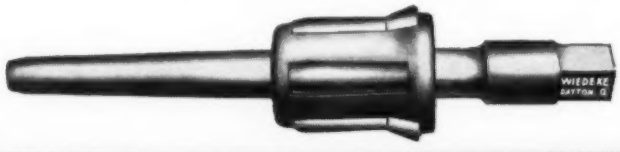

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the availability of the Precision Gage Laboratory to industry for calibration of precision measuring standards, instruments and manufactured components.

59 RESEARCH CENTER—Jeffrey Mfg Co, Columbus 16, Ohio. 6-page brochure, entitled "Quality of Product is Essential to Continuing Success," covers the company's new research center for study of Jeffrey equipment, such as conveying and crushing machinery.

60 HYDRAULIC OILS—E F Houghton & Co, 303 W Lehigh Ave, Philadelphia 33, Pa. 48-page "Handbook on Hydraulic Oils" covers specifications, importance of properties not included in usual specifications, additives and qualities a good hydraulic oil must possess.

61 STEAM JET HEATER—Schutte & Koerting Co, 12th & Thompson St, Philadelphia 22, Pa. 20-page catalog No. 3A describes various steam jet heaters and sparger nozzles, together with general information on their construction and operation.

62 CENTRAL HEATING—Ric-wiL Co, Cleveland, Ohio. 12-page folder covers a number of Pittsburg's institutions that have central heating. Photos and diagrams are included.

63 STEAM HUMIDIFIERS—Armstrong Machine Works, Three Rivers, Mich. 12-page bulletin No. 177 explains need for humidification and how to achieve it.

64 COMPRESSOR STATIONS — Clark Bros Co, Olean, N. Y. 4-page article, entitled "Field Compressor Stations," by C S Worley, will be of vital interest to everyone connected with production and transmission of natural gas.

65 CENTRIFUGAL BLOWERS AND EXHAUSTERS—Air Appliance Div, U. S. Hoffman Machinery Corp, 105 4th Ave, New York 3, N. Y. 12-page booklet No. A-650 describes many applications of Hoffman blowers and exhausters that require air pressure from one to eight psi on vacuum from two to 11½ in. of mercury.

66 STEAM AND LIQUID CONTROL EQUIPMENT—O C Keckley Co, 400 W Madison St, Chicago 6, Ill. 4-page catalog No. 48MC features pressure regulators, temperature regulators, combination pressure and temperature regulators, self-cleaning strainers and steam traps.

67 TEMPERATURE REGULATOR — Leslie Co, 50 Delafield Ave, Lyndhurst, N. J. 4-page folder, entitled "Controlled Heat," describes line of Class T self-contained, self-acting, temperature regulators.

68 STEAM COILS—American Blower Corp, Detroit 32, Mich. 26-page bulletin No. B-1318 covers Type H steam coils for industrial and process heating.

69 PROTECTIVE COATINGS — Amercoat Div, American Pipe and Construction Co, P O Box 3428, Terminal Annex, Los Angeles 54, Calif. 12-page catalog gives complete details on chemical and physical properties, application instructions and other pertinent data on protective coatings.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **SYNTHETIC RUBBER PACKINGS** —E F Houghton & Co, 303 W Lehigh Ave, Philadelphia 33, Pa. 112-page handbook describes application and design of synthetic rubber packings of all types, both fabricated and homogeneous.

70 NICKEL HISTORY — International Nickel Co, 67 Wall St, New York 5, N. Y. 60-page booklet, entitled "The Romance of Nickel," relates the history of nickel through the ages. It also tells how nickel is produced, what it is used for, research and future of nickel.

71 DIESEL GENERATOR SETS—General Sales Office, Superior Engine Div, National Supply Co, Springfield, Ohio. 8-page bulletin No. 4709 describes and gives dimensions and specifications of Superior diesel generator sets.

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BOMBAY, INDIA: Dissatisfied with earlier arrangements for supplying electrical power to southern Bombay province from Mysore State's huge hydroelectric station at Jog Falls, the Bombay provincial government is now pressing survey of the Kalindi River in the same section. Studies already completed indicate that up to 340,000 kw could be generated at a station at the foot of the west coast mountain range. The provincial government favors the project over purchase of 3750 kw from Mysore at a rate of roughly 48c per unit, as called for under the agreement that yielded its water rights on the border-making Sharavati River, which Jog Falls utilizes.

ZURICH, SWITZERLAND: Work has started again on two large hydroelectrotechnical plants in southern Tyrol with financial support supplied by Swiss Electrowatt Corp and several other Swiss finance companies in amount of 30 million Swiss francs. The Montecantini concern is in charge of the construction project, which was begun before the war and then halted when Italy entered the war. Repayment of this financial aid will be in form of electric power, principally winter energy. City of Zurich will receive part of that power in return for a participation of 25% in financing the project.

These two power plants on Lake of Reschen, at Glorenza and Castelbello, are expected to begin operation by winter of 1948–1949. Capacity production will total about 650 million kwhr. Over 5000 men are employed in building an 80-ft-high dam. Dam basin, into which the Etsch River will flow, will hold 100,000 acre-ft of water. A high-tension line of 220,000 v is being built on the Stilfserjoch to carry power from these works to northern Italy.

PERTH, WESTERN AUSTRALIA: The island continent's forgotten third, western Australia, is going in for industrialization and electrification in a big way. The state's first major electric power plant, and still the biggest, was installed in 1916. Many small and uneconomical diesel units were built during and since the war.

Erection of a large modern powerhouse at South Fremantle, investigation of an electric power-supply scheme for subtropical northwest, and establishment of a power-supply system in the southwest of the state are making rapid progress. Farthest reaching of these state-sponsored power projects is the southwest system, which is the first step in development of a statewide grid system. A state electricity commission has been set up in Perth to provide necessary executive power for a long-range policy that will enable regional power projects to be coordinated on eco-

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Whatever your control requirements may be, it is conceded that the switch in a control warrants first consideration, due to its functional characteristics. All Mercoid Controls are equipped exclusively with hermetically sealed mercury switches of special design and selected materials.

Mercoid mercury switches are known the world over for their dependable service. They are not affected by dust, dirt or corrosion; nor are they subject to open arcing with its attendant consequences of pitting, sticking or oxidized contact surfaces, all of which, are likely to interfere with normal switch operation.

That is why among other things, Mercoid Controls on the whole give you assurance of better control performance and longer control life—a distinct and unfailing advantage—the reason why they are also the choice of America's leading engineers for many important industrial applications.

MERCOID CONTROLS are available in a variety of types for sensitive control of Pressure, Temperature and Lever actuation.

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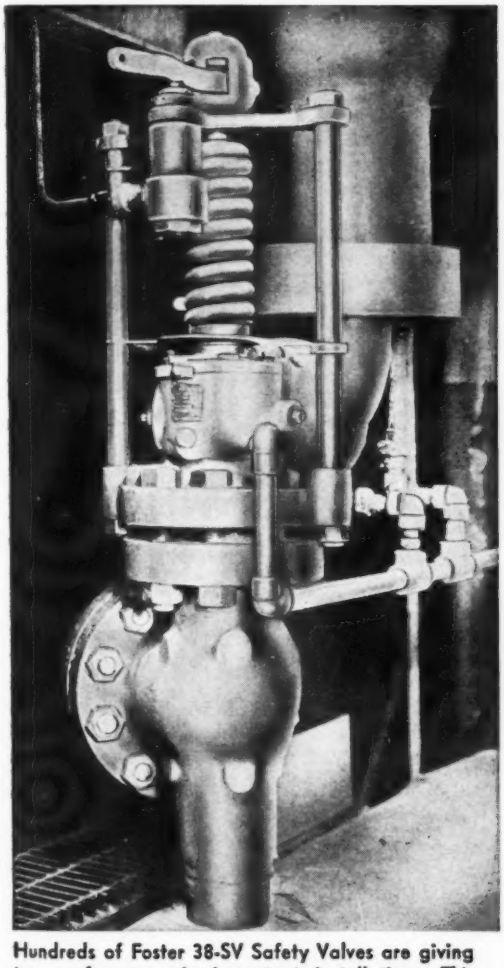
Give Your Boilers a Break!

End Safety Valve Troubles by Installing FOSTER 38-SV Safety Valves with these 5 GUARANTEED ADVANTAGES:



Hundreds of Foster 38-SV Safety Valves are giving top performance in important installations. This 2½" superheater unloading valve operates at 1450 lb., 950° total temp. Others are in service up to 2575 lb. at 1000° F.

1 Built to Stay on the Job—the Foster 38-SV is the SAFETY valve that is built to pop without causing boiler outages. On accelerated tests in an Eastern Utility, one of these valves has been popped every day for more than 6 years. It has had only routine maintenance, and yet it pops consistently at set pressure, and does not leak. In the Chief Engineer's own words—this is the equivalent of at least 40 years' normal service.

2 Accurate Popping—Once set at the desired popping point, the Foster 38-SV pops on the button for each successive pop. For instance, in another Utility installation, the 38-SV under test was set for 600 lb. and popped 50 times in quick succession. The first pop was at 600 lb. and the 50th pop was at 595 lb. In spite of the heat of this abnormal operation, the Foster 38-SV was thrown off less than 1%. After a short cooling period, it again popped at 600 lb. That's test gauge accuracy!

3 Minimum Blow-down—Foster 38-SV's are adjustable so they can be set to reseat when pressure has dropped as little as 1% below the popping point. In this same test the 38-SV, on its first pop, reseated at 594 lb. for a 6 lb. or 1% blow-down. On the 50th pop, it reseated at 589 lb. which is also 6 lb. or 1%. After each pop, it reseated positively with no chattering or leakage. Only over-pressure up the stack—no useful steam wasted.

4 High Relief Capacity—Foster 38-SV's have larger bore because they can handle larger volume of steam and still control blow-down. Depending on operating conditions, they may give more than twice the capacity of other makes, as in the case of 5 Foster 38-SV's required to replace 12 "conventional" safety valves of the same nominal size. Fewer valves to buy—fewer valves to service.

5 Low Maintenance—Hot or cold, the piston in the 38-SV fits loosely and cannot stick, and yet no steam reaches the spring. The spring stays cool enough to touch, even while the valve is popping—which means longer spring life. Disc and seat expand at the same rate during heating-cooling cycles—there is no drag to destroy seating surfaces. Simmering and chattering have been eliminated as a source of destruction. Discs will not warp or crack. When routine inspection and maintenance are indicated, complete loading assembly lifts out without disturbing the spring setting.

For full details on the design and construction features that enable this valve to outperform any other safety valve, get in touch with your Foster Representative or with us direct.

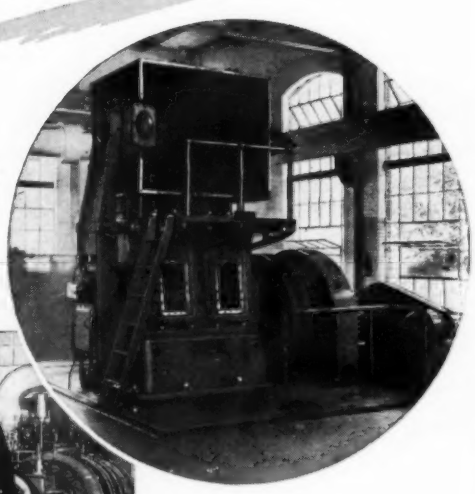
FOSTER ENGINEERING Company

PRESSURE REGULATORS...RELIEF AND BACK PRESSURE VALVES...AUTOMATIC STOP AND CHECK VALVES...ALTITUDE VALVES...DAMPER REGULATORS...FAN ENGINE REGULATORS...PUMP GOVERNORS...TEMPERATURE REGULATORS...LIQUID LEVEL CONTROLLERS...FLOAT AND LEVER BALANCED VALVES...NON-RETURN AND TRIPLE DUTY VALVES...VACUUM REGULATORS OR BREAKERS...SIGHT FLOW BOXES...STRAINERS...SAFETY VALVES...SIRENS

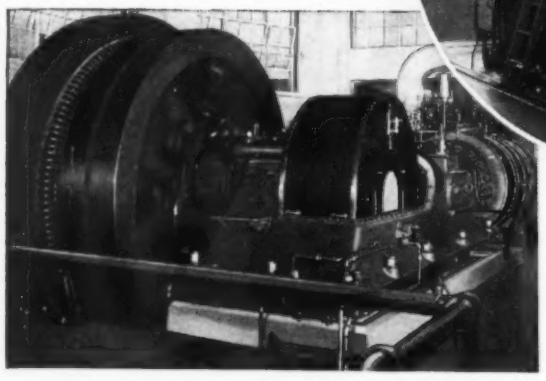
106 MONROE STREET • NEWARK, N. J.

Skinner "UNIVERSAL UNAFLOW"

Steam Engines



VERTICAL TYPE



HORIZONTAL TYPE

● WHAT THEY ARE

The Skinner "Universal Unaflow" Steam Engine is the outstanding reciprocating prime mover of this era, made by the largest exclusive manufacturer of steam engines in America. The performance of thousands of "Universal Unaflow" engines, in almost every type of industry and institution, daily demonstrates the truth of our claim—that they are "the most economical steam engines built."

"Universal Unaflow" engines are correctly designed for simplicity, dependability, heavy duty service, flexibility, and permanently maintained economy. They are available in sizes ranging from 75 to 2,250 horsepower, and in horizontal or multi-cylinder vertical types.

● WHAT THEY DO

Skinner "Universal Unaflow" Steam Engines are built for direct connection, coupling, or belt drive, to electric generators, compressors, blowers, pumps, lineshafts, or other load.

Over 2000 power users, in industries and institutions, have found it more economical to generate their own power with "Universal Unaflow" engines than to purchase power from the local utility, or to generate power with other prime movers.

Exhaust steam is available to be utilized for heating, for laundry, for processing techniques, and many other purposes, further adding to the savings enjoyed through use of "Universal Unaflow" engines.

Skinner "Universal Unaflow" engines are frequently bought under our Guaranteed Saving Contract, payments being made out of proved savings after the engine is in service. Write for detailed information of the advantages of Skinner "Universal Unaflow" engines in your industry.

For Over 76 Years, Doing One Thing Well—Building Steam Engines

SKINNER ENGINE COMPANY, ERIE, PA.

nomical and strategic lines. Many unpayable small diesel units will be eliminated and thousands of farm households wired for electricity.

The southwest project will be completed in three stages. It is developing around sub-bituminous coal deposits at Collie. The small steam power plant at Collie will be enlarged to an initial capacity of 12,500 kw, which in the thinly settled perimeter around the station is sufficient to provide 40 townships with electricity.

A 10,000-kw station is planned at Bunbury, the railhead for Collie on the coast, south of Perth. The two stations will be linked. Work has commenced on the new metropolitan power station at South Fremantle. This will supersede the obsolete 40-cycle 53,500-kw East Perth power station that is running with one of the highest load factors in the world. South Fremantle will have an initial installed capacity of 50,000 kw and will cost $7,000,000. Two additional 25,000-kw units will be added later to provide 75,000 kw of running plant and 25,000 kw standby capacity. East Perth, South Fremantle, Collie and Bunbury systems will be interconnected. The grid will operate at 50 cycles, replacing present 40-cycle system in the state. The ultimate transmission voltage will be 132 kv.

With establishment of another regional power plant at Geraldton to link with the Perth-South Fremantle system the grid net will cover an area as big as California, extending from the subtropical northwest to the whaling station of Albany on south coast of the state.

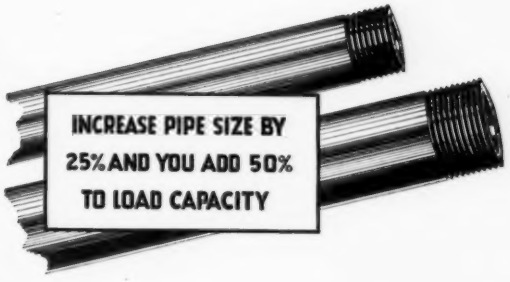
BUENOS AIRES, ARGENTINA: An appropriation of $559,000,000 was authorized for energy development in the 1947–1948 budget approved by executive decree. This figure will be subdivided as follows: $160,000,000 for water works, $121,250,000 for electricity, $155,000,000 for petroleum, $80,000,000 for gas, $40,000,000 for solid minerals, etc.

E F Drew & Co has prepared a 10-min 16-mm motion-picture film with sound, entitled *A Study in Boiler Water Treatment.* Picture, filmed in Drew research laboratories at Boonton, N. J., covers main difficulties in boiler-water treatment, such as scale and corrosion and their correction. By a 1000-psi foaming boiler, fitted with sight glass, foaming and priming are shown in a manner that closely duplicates these phenomena in a high-pressure boiler. The company offers this picture without charge to engineering societies and other interested groups. Write to Power chemicals div, E F Drew & Co, 15 E 26th St, New York 10, New York, for information concerning use of this film.

Sulflo, Inc, 1143 E. Jersey St, Elizabeth 4, N. J., has announced an expansion of its line of plumbing, steamfitting and metal-working specialties. The expanded line, to be known as Sulflo *Quality Line,* includes solder fluxes, pipe-joint compounds, penetrating oil, layout liquid and a new all-purpose cutting compound, in addition to plumber and steam-fitters service items.

INSTALL STEEL PIPING ADEQUATE FOR TOMORROW'S NEEDS

...because "oversize" pipe went in in '44



IT was a forward-looking engineer who specified "oversize" steel pipe a few years ago. If he had been satisfied with sizes barely adequate to do the war-time job, he would now be making major changes to meet a 50% load increase facing him this year.

You can also apply this thought to today's pipe installations,--looking ahead to make sure you are anticipating steam and processing loads of the next five to ten years.

Too many owners and contractors, are content to think only of today. To some it may seem economical to stick to the minimum sizes with which they can "get by." But, of course, it's common sense and long-run economy to plan for future needs as well as present, when you invest in equipment as permanent as steel pipe.

Youngstown Distributors join us in recommending Youngstown Steel Pipe in sizes adequate for tomorrow's needs.

YOUNGSTOWN

THE YOUNGSTOWN SHEET AND TUBE COMPANY

GENERAL OFFICES - YOUNGSTOWN 1, OHIO

Export Offices - 500 Fifth Avenue, New York City

Manufacturers of

CARBON - ALLOY AND YOLOY STEELS

Pipe and Tubular Products-Sheets-Plates-
Electrolytic Tin Plate-Coke Tin Plate.

Conduit - Bars - Rods - Wire - Cold Drawn
Carbon Steel Rounds-Tie Plates and Spikes.

Makes ALL VALVES *INSTANTLY* Accessible

CONTROL FROM THE FLOOR

● Instant, handy, safe control of overhead and other out-of-reach valves. Eliminate danger to employees; banish the stepladder. Now — install valves anywhere they should be, regardless of accessibility.

Inexpensive BABBITT Sprocket Rims fit all types and makes of valves, with either rising or non-rising stems. Installed quickly by clamping directly onto hand wheel of valve. Eliminates makeshift apparatus and specially-made chain wheels.

● Ten standard sizes take care of all valve wheels from 2 to 30 inches in diameter.

● *Request Catalog Bulletin P, prices, name of local distributor:*

Babbitt *Adjustable* SPROCKET RIM *with Chain Guide*

BABBITT STEAM SPECIALTY COMPANY

Manufacturers of Adjustable Valve Operating Mechanisms

New Bedford, Mass., U. S. A.

EXTRA SERVICE

"STANDCO" PILLOW BLOCKS

There's Extra Value in these rugged well-designed "Standco" Pillow Blocks with their life-long, trouble-free service.

They are fully able to "take it," and have babbitted, accurately broached bearing surfaces, with faces machined to a "T." Easy to clean, easy to lubricate.

Write for Bulletin.

Sold entirely through Industrial Distributors

Over 45 Years in Business

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA., BOX 577

Boston • Chicago • Detroit • Indianapolis

St. Louis • San Francisco

CRYER TRAPS

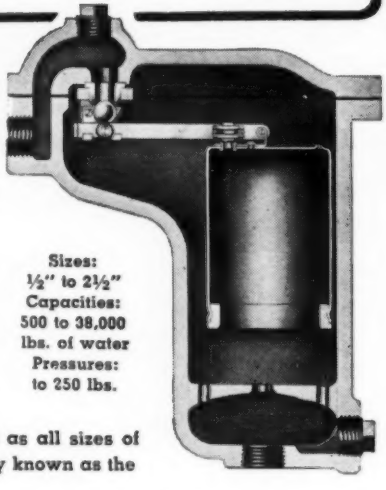
Really Operate as TRAPS NOT as Trouble Makers

The headline of this advertisement expresses the concensus of opinion of Cryer users. It says in a few words that Cryer Traps do not bind or dribble . . . are quick venting and practically self-cleaning . . . requiring practically no maintenance or attention . . . in other words they "Really Operate".

You, too, can be assured of satisfactory, economical, trouble-free operation by installing Cryer Traps on your steam lines and once you have done so, you, too, will be a booster for these modern, simple, easily installed steam traps.

Cryer Traps are available everywhere through leading distributors.

Also thermostatic Radiator Traps as well as all sizes of traps and repair parts for the line formerly known as the J-M Ball Steam Trap.



Sizes: ½" to 2½" Capacities: 500 to 38,000 lbs. of water Pressures: to 250 lbs.

Cryer traps are available everywhere through leading distributors

Manufacturers of Steam Specialties for over forty years.

CRYER TRAP AND VALVE CO., INC.

366 MADISON AVE. NEW YORK 17, N. Y.

APPOINTMENTS

Link-Belt Co has named Leonard C Heinlein to newly created position of assistant superintendent at ball and roller bearing div plant in Indianapolis. Columbus Basile has been made superintendent of Caldwell plant at 2410 W. 18th St, Chicago.

E M Powell has been appointed Middle Atlantic district manager of Sturtevant div of **Westinghouse Electric Corp,** with offices in Philadelphia. Powell will direct sales and installation of air-handling and air-conditioning equipment throughout Del., Md., Va., most of Pa., and parts of W. Va. and N. J.

W A Neumann Jr has been made factory controller, assistant treasurer and assistant secretary of **De Laval Steam Turbine,** Trenton, N. J., succeeding C J Kushell Jr, who has resigned.

Thermoid Co has announced following personnel changes: (1) Jack Brand will handle sales for Colo., with headquarters at Denver. (2) J J Chamberlain will handle industrial sales in state of Washington and northern half of Ore., with headquarters in Seattle. (3) E J Dunlap has been transferred from Trenton, N. J., where he headed industrial sales promotion, to San Francisco, Calif., where he will have charge of industrial sales for northern half of Calif, and southern Ore. (4) A Fred Matheis assumes duties of industrial sales promotion manager. (5) H William Overman has transferred his headquarters to Thermoid office at 422 Boulevard Bldg, Detroit, Mich. He will continue to direct industrial friction material sales from that office. (6) Jack Wright, who will headquarter at Salt Lake City, Utah, has been assigned industrial and oil field sales in Utah, Idaho, Wyo., Mont. and western Canada.

C C Walker has been elected a commercial vice-president of **General Electric Co.** Walker assumes responsibility for customer relations in New England territory, with headquarters in Boston. He succeeds T S Knight, who retired Dec 31 after 44 years of service with the company. Joseph F Eckel has been promoted to manager of Lynn River Works. Eckel succeeds George M Stevens who retired Dec 31 after 46 years of service. Four new appointments in apparatus dept have been announced: W V O'Brien has been named assistant general manager of sales; R M Darrin, manager of central station divisions; J C Miller, assistant to manager of sales; and H P Bish, manager of aircraft, federal and marine divisions.

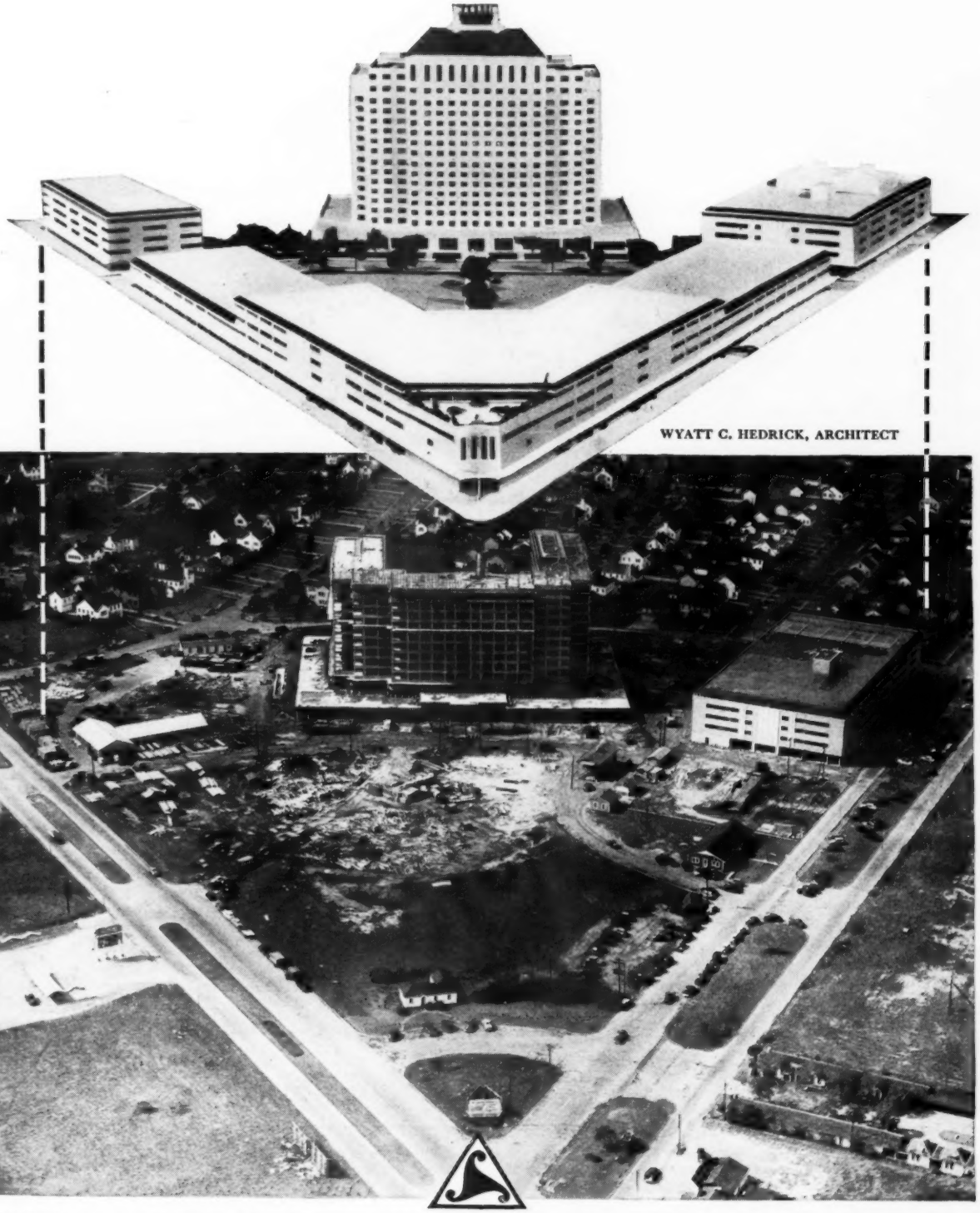
General Electric Co has announced four appointments in control divisions of apparatus dept: (1) M H Blesh has been made manager of manufacturing. (2) C B Bradish has been named manager of engineering. (3) E A Green has become manager of sales. (4) Thomas I Hage has been made accountant for the divisions.

Blackmer Pump Co announces that its Ohio sales representative, William Berrington & Son, Inc, has purchased an additional

COMMUNITY CENTER

The McCarthy Center, now under construction in Houston, Texas, will comprise the 18-story Shamrock Hotel; a garage to house 1,275 cars; a shopping center of several buildings; a theatre seating 1,750, complete with concert stage; a 50-meter swimming pool; and a 15-acre parking lot.

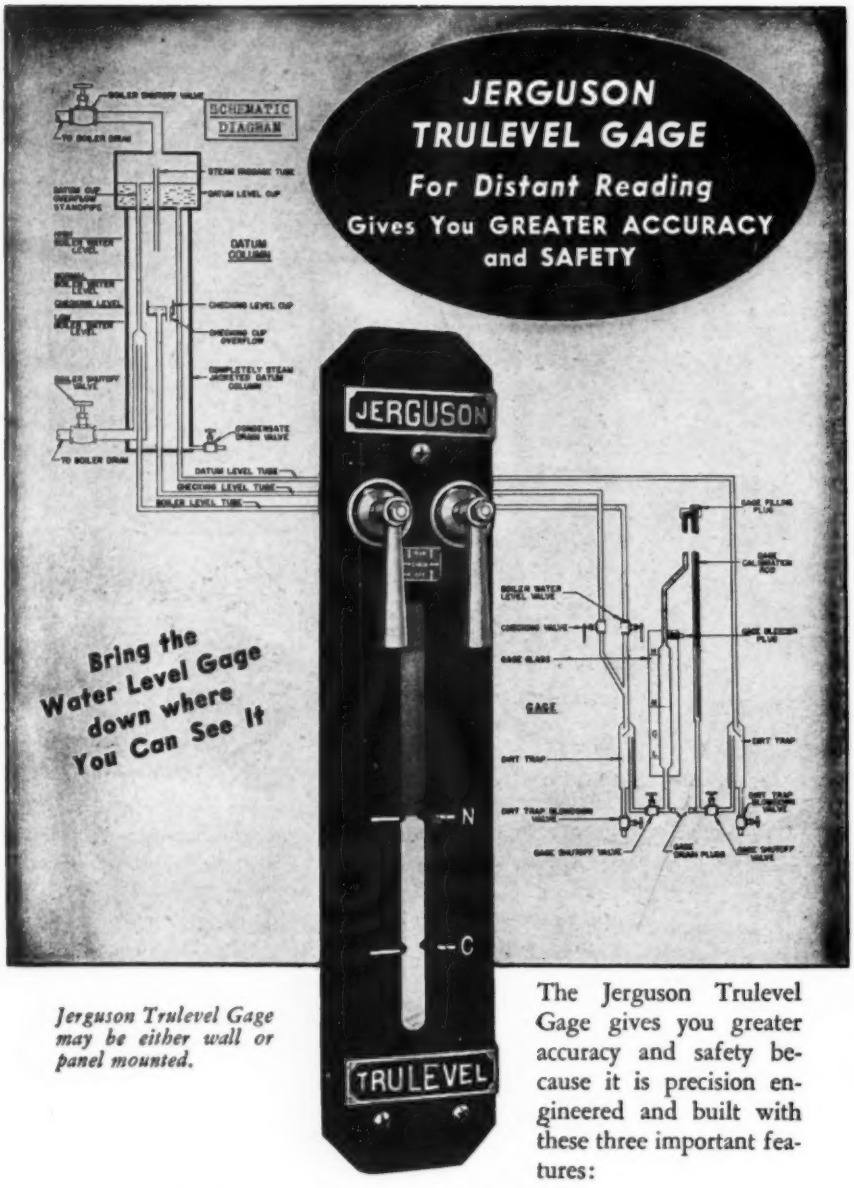
Stone & Webster Engineering Corporation are the project managers for the construction of this comprehensive community center.



WYATT C. HEDRICK, ARCHITECT

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.



Jerguson Trulevel Gage may be either wall or panel mounted.

The Jerguson Trulevel Gage gives you greater accuracy and safety because it is precision engineered and built with these three important features:

1. Built-in checking feature for quick, easy checking of accuracy and operation. **2.** Easy-to-read water level indication. Water level appears in natural position, contrasted with brilliant blue of manometric fluid above. Back-illuminated. **3.** Positive reading through new datum column, which is fully steam jacketed and duplicates the temperature and specific gravity conditions which exist in the boiler drum.

Stainless steel construction for long, dependable service. Black crackle finish aluminum cover.

Three standard sizes: #1, for pressures up to 600 lbs. #2, for pressures up to 900 lbs. #3, for pressures over 900 lbs.

Write for Engineering Data Unit

JERGUSON
GAGE & VALVE COMPANY
100 Fellsway • Somerville 45, Mass.
Representatives in Major Cities . . . Phone Listed Under JERGUSON

7000 sq ft of warehouse space in Cleveland. Berrington sales territory has been increased and now includes about all of the state of Ohio, southern Ind. and northern Ky. Berrington organization is headed by William E Berrington. George A Baldwin has been made manager of Los Angeles sales office of Blackmer Pump Co.

R O Bell has been promoted to engineer-in-charge of transformer sales of **Allis-Chalmers** electrical dept.

George J Zimmerman, president of **Strong, Carlisle & Hammond Co** since 1940 and manager of its machinery div for more than a decade, retired Dec 31. Edward L Mack succeeds him as manager of machine tool div. Harry H Smith, manager of Mac-it div, also retired on the same date. Stanton C Gunnett succeeds Smith as manager of Mac-it div.

I-T-E Circuit Breaker Co, Philadelphia, has announced election of Roy E Murphy to vice-president in charge of sales. He will be in charge of I-T-E sales programs and coordinating combined selling of I-T-E and its subsidiary, the Railway and Industrial Engineering Co, Greensburg, Pa. J Fred Getz has been appointed sales manager of I-T-E Circuit Breaker Co, with complete control over sale of switchgear products.

John S Krauss has retired as manager of L H Gilmer div of **U. S. Rubber Co,** Philadelphia, after 35 years of service. Lawrence K Youse succeeds Krauss.

Pacific Pumps Inc completed an agreement with Pulsometer Engineering Co, Ltd, Reading, England, for manufacture of Pacific centrifugal line for distribution throughout Europe and the Near East. Pumps and spare parts made at Reading will be interchangeable with those made in the U. S.

Merger of Robertshaw Thermostat Co of Youngwood, Pa., Fulton Sylphon Co of Knoxville, Tenn., and Bridgeport Thermostat Co of Bridgeport, Conn., under name of **Robertshaw-Fulton Controls Co** has been announced by John A Robertshaw, president of the new organization. J V Giessler was elected executive vice-president in charge of Fulton Sylphon div., Knoxville, Tenn., and Bridgeport Thermostat div, Bridgeport, Conn. T T Arden was made executive vice-president in charge of Grayson controls div, Lynwood, Calif.

Raybestos-Manhattan, Inc, Manhattan Rubber Div, Passaic, N. J., appoints P L Edwards assistant manager of central district office in Pittsburgh.

C A Dunham Co announces removal of its Chicago offices to 400 W. Madison St. Manufacturing plants remain at Marshalltown, Iowa, and Michigan City, Ind.

John B Ives has been named vice-president in charge of production at **Laclede-Christy Clay Products Co.** Ives continues to make his headquarters at Laclede Christy offices in St. Louis. Arthur B Morse has

POWER

WHEN EXIDE BATTERIES DO THE CRANKING DIESEL ENGINES START

On Diesel engines, in every field of service, powerful Exide Batteries are giving a good account of themselves. They are on the highway, cranking Diesel powered trucks and buses; off the highway on construction equipment of many kinds; on ships and railroad locomotives; in power plants and wherever Diesel engines are used.

Exide Batteries are preferred by Diesel engine manufacturers and operators because they are built specifically for the job. They have the extra power and ruggedness the work requires, plus an ability to withstand long, hard service in any climate.

Write today for a FREE copy of the Exide Catalog on Heavy-Duty Batteries. It gives you catalog data and information on how to get the most from your Diesel Cranking Batteries.

Exide BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32
Exide Batteries of Canada, Limited, Toronto

A BETTER STRAINER

for BETTER SERVICE

- A good strainer protects your equipment and pipelines.

  There's a reason for the popularity of Yarway Fine Screen Strainers. *They give better service.*
- *SCREEN* is a high-grade woven monel wire basket that catches solids—lets condensate, oil or other fluids flow freely. Perforated screens if desired.
- *BODY* is cadmium-plated for protection against corrosion and also for better appearance.
- *SCREEN CAP* is easily removed. Machined face and spark plug gasket provide tight joint. Cap and screen come out together. Screen automatically aligns when replaced.
- Six sizes, ½" to 2", for pressures up to 600 lbs. Reasonably priced.
- Hundreds of thousands are already in service. Stocked and sold by 150 Mill Supply Houses.
- See your nearest distributor or write for Bulletin S-201.

YARNALL-WARING COMPANY
100 Mermaid Ave. Philadelphia 18, Pa.

YARWAY STRAINERS
"Police the Pipelines"

become vice-president and assistant director of sales. He will make his headquarters at executive offices in St. Louis.

Liquid Conditioning Corp announces addition of John R Lill to staff of its Washington, D. C., representative, L S Luther & Co. L S Luther & Co, with offices at 1018 18th St, N. W. Washington 6, D. C., and 102 E. 25th St, Baltimore 18, Md., covers the District of Columbia and states of Md. and Va.

J L Howarth has been named general sales manager of **Anderson Brass Works, Inc,** Birmingham, Ala.

W B Whenthoff has returned to Houston and again is in charge of marketing products of **Tube Turns, Inc,** in that area.

Saran Lined Pipe Co, a newly organized firm, has been made exclusive distributors for **Dow Chemical Company's** recently developed specialty pipe and fittings.

Yale & Towne Mfg Co announces two new appointments to national sales force for electrical appliances: Philip Trent has been assigned sales area covering Mo., Kan., Neb. and western Iowa. H Bennett McDonald has been given a sales area covering Wash., Ore., Calif., Nev. and Ariz.

Ross Irwin has resigned from **Springfield Boiler Co,** Springfield, Ill., to engage in consulting engineering work in the Middle West. As a consulting engineer, he is specializing particularly in helping operating engineers obtain and maintain optimum operating results with existing equipment. He is also available as a consultant on the steam-generating portion of new plant design. His headquarters are in Springfield, Ill., P O Box 178.

Harbison-Walker Refractories Co has named E M Sarraf Cleveland district sales manager.

W E Hammond has joined the staff of **Air Preheater Corp.** He will be at Wellsville, N. Y., plant.

American Brake Shoe Co has named N George Belury vice-president of engineered castings div and Harry C Pratt works manager. Both men will continue to be at div headquarters in Rochester, N. Y.

Gerald Wilson has been appointed district contract manager for Eastern district by **H K Ferguson Co,** industrial engineers and builders of Cleveland, New York and Houston. Wilson will supervice sales activities for eastern district domestic market and export div, which is now operating extensively in South America and Far East.

Davey Compressor Co, Kent, Ohio, has named H A Pratt parts and service manager.

J J Miller has been appointed plant manager of Zelienople, Pa., plant of **Johns-Manville Corp.** Miller succeeds S K Cooper, who resigned. Johns-Manville has purchased Van Cleef Bros, of Chicago,

. . . You get everything . . .

your piping job needs

in the TAYLOR FORGE *line*

Widest range of types . . . sizes . . . weights . . . materials

To Taylor Forge "full line" means just what it says. The broad Taylor Forge line—more complete than that of any other manufacturer—includes practically every type of fitting, every weight, every size, and every material ever needed in pipe welding.

Yes, Weldells have everything

TAYLOR FORGE
& PIPE WORKS

General Offices & Works: Chicago 90, Ill. (P.O. Box 485)

EASTERN PLANT: CARNEGIE, PA.

DISTRICT OFFICES

New York: 50 Church Street Philadelphia: Broad Street Station Bldg.
Chicago District Sales: 208 S. LaSalle Street
Houston: City National Bank Bldg. Los Angeles: Subway Terminal Bldg.

"GUNITE" Concrete

(since 1915)

Linings for

STEEL BUNKERS •
DUCTS, HOPPERS •
STACKS •
UPTAKES •
BREECHINGS •
STEEL & PIPE •
ENCASEMENT •
FIREPROOFING •

GUNITE CONCRETE & CONST. CO.

1301 Woodswether Road
KANSAS CITY 6, MO.

R. N. Turner, Dist. Mgr., 228 Nor. La Salle St., Chicago 1, Ill. B. H. Mueller, Distr. Mgr., 8625 Delmar Blvd., University City, (St. Louis), Mo. Philip D. Barnard, Distr. Mgr., 2836 Addison, Houston 5, Tex.

Branch Offices: New Orleans, Dallas, Denver.

The IMO PUMP requires no gears, because the fluid pumped is propelled from suction to discharge by the action of three intermeshing rotors. That's all there is to it—no gears, valves, vanes or pistons!

For simplicity, reliability and compactness select the IMO—for use in hydraulic service, governor service, lubrication service and other fluid handling services.

For further information send for catalog 1-132-P

IMO PUMP DIVISION
of the
DE LAVAL STEAM TURBINE CO.
TRENTON 2, NEW JERSEY

Dutch Brand industrial and automotive products. The Chicago firm will be operated as a wholly owned subsidiary of Johns-Manville Corp. No change is being made in manufacturing, merchandising or distribution system. Present personnel is being continued in the Van Cleef organization.

Appointment of H M Cahill as sales manager, small engine dept, is announced by heavy machinery div, **Nordberg Mfg Co,** Milwaukee 7, Wis.

Dravo Corp, Pittsburgh, Pa., has named William H Collins director of advertising.

Joshua L Miner has retired as vice-president of Lumnite div, **Universal Atlas Cement Co,** U. S. Steel Corp subsidiary. Frank E Lobaugh succeeds him as manager of Lumnite div.

Stewart-Warner Corp has elected Samuel Insull Jr vice-president. Insull continues to be in charge of radio div.

Ingersoll steel div, **Borg-Warner Corp,** has announced appointment of works managers of Chicago and Kalamazoo, Mich., plants. The Chicago post goes to Joseph A White. The Kalamazoo post will be filled by Milo F McCammon. Robert S Ingersoll, who formerly served as works manager for both plants, will now be enabled to devote his full time to his duties as vice-president of Ingersoll steel div in charge of manufacturing at Chicago, Kalamazoo and Evansville, Ind., plants.

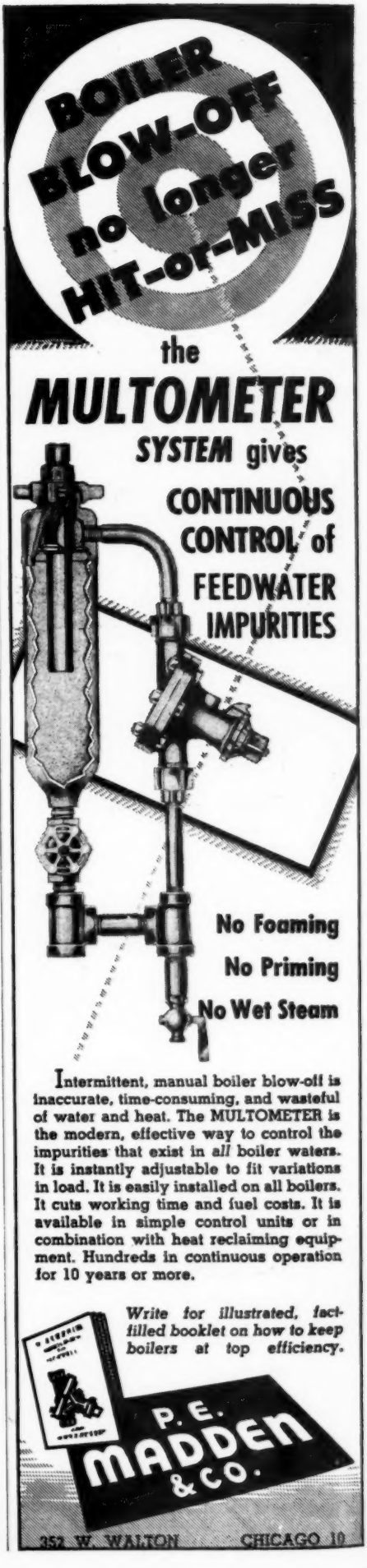
Hewitt-Robins Inc has named Industrial Equipment Co, Louisville, Ky., as a distributor of entire Hewitt rubber division's line of industrial hose, belting and packing. Industrial Equipment Co will serve all industries with Hewitt line within a 45-mile radius of Louisville.

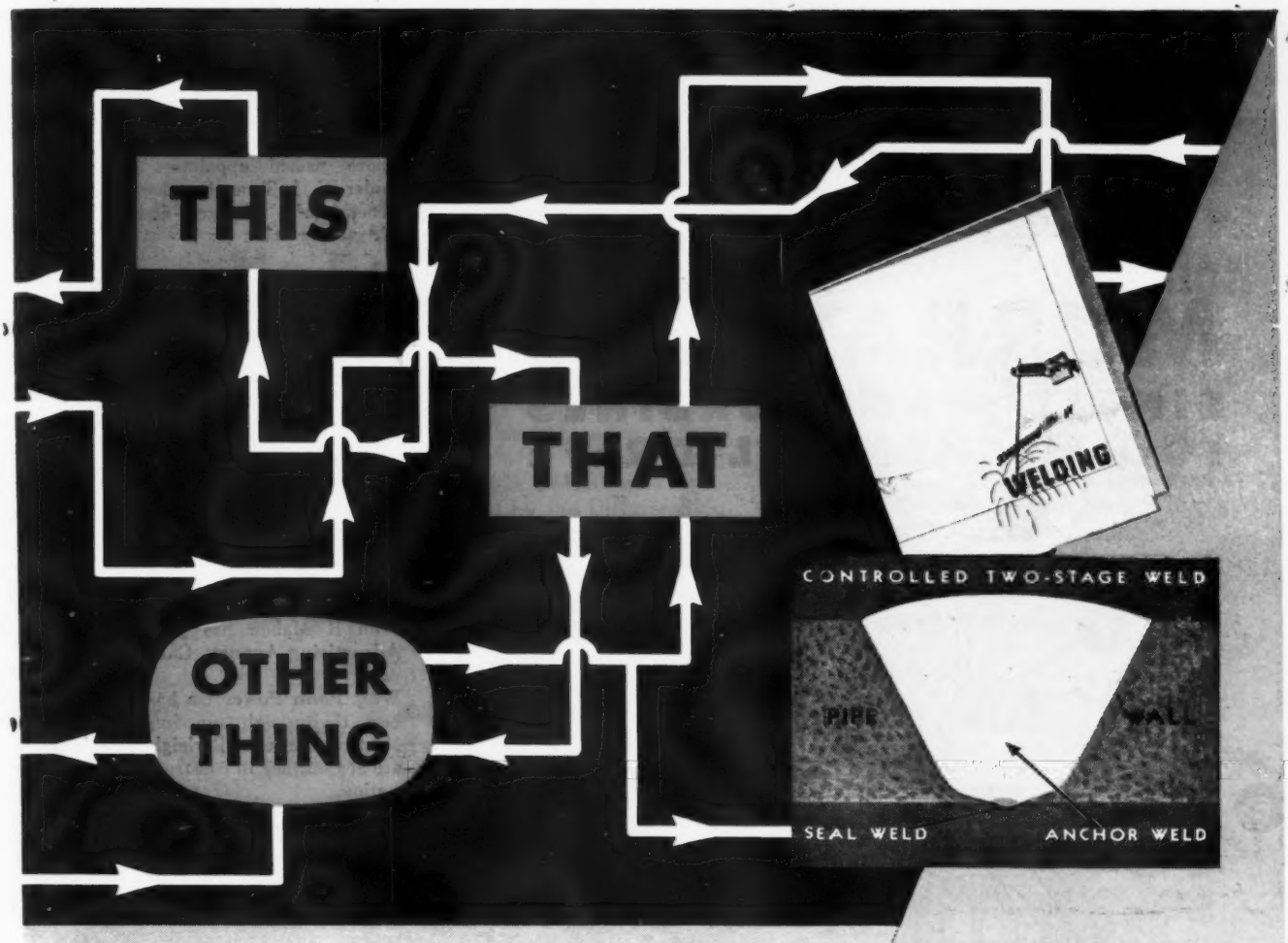
Alfred D Pool has become manager of electric motor sales in Midwest and East for **A O Smith Corp** of Milwaukee, Wis. His headquarters are in Chicago office.

Monsanto Chemical Co announces appointment of Tom K Smith Jr as assistant branch manager of phosphate div. Smith will be in charge of Cincinnati branch of division's Detroit office. Territory served by Cincinnati office embraces parts of Ky., Ohio, W. Va. and Ind. In this territory Smith will supervise sales of all phosphate div products.

Vice Admiral George F Hussey has joined staff of **American Standards Assn** and assumes duties as administrative head. Cyril Ainsworth serves with Hussey as director of operations of ASA staff. Dr P G Agnew continues his service to ASA as consultant.

Carborundum Co announces following appointments to its sales organization: (1) W T McCargo has been named assistant director of sales in charge of operations in western region, with headquarters in Chicago. (2) John S Hawley has been appointed assistant director of sales in cen-


BOILER BLOW-OFF no longer HIT-or-MISS
the
MULTOMETER
SYSTEM gives
CONTINUOUS CONTROL of FEEDWATER IMPURITIES
No Foaming
No Priming
No Wet Steam
Intermittent, manual boiler blow-off is inaccurate, time-consuming, and wasteful of water and heat. The MULTOMETER is the modern, effective way to control the impurities that exist in all boiler waters. It is instantly adjustable to fit variations in load. It is easily installed on all boilers. It cuts working time and fuel costs. It is available in simple control units or in combination with heat reclaiming equipment. Hundreds in continuous operation for 10 years or more.
Write for illustrated, fact-filled booklet on how to keep boilers at top efficiency.
P.E. MADDEN & CO.
357 W. WALTON CHICAGO 10



HIGH TEMPERATURE AND PRESSURE PIPING

Engineered-Prefabricated-Installed-Guaranteed

THIS . . . THAT . . . and the OTHER THING in the above chart represents any equipment in a power or process plant that must be hooked-up with high temperature and high pressure, carbon or alloy steel piping. We have the organization, facilities and certainly the experience (48 years) to relieve you of all responsibilities of the "hook-up," from the preliminary engineering to final completion to meet any code or insurance requirements. Will you give us a chance on your next job, whether your "this-that-other thing" be a complete new plant or an addition of new equipment? And may we send our bulletin, "Something New in Welding," describing the patented Mitchell-Westport Joint which prevents weld metal protrusions inside the pipe without the use of backing rings?

WESTPORT JOINT

(PATENTED)

W. K. MITCHELL & CO., INC.

2944 ELLSWORTH STREET

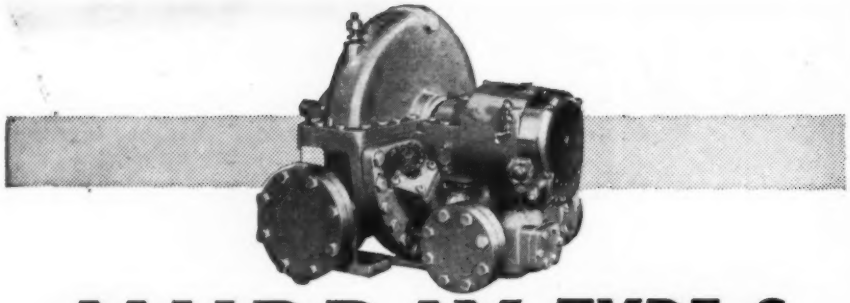
PHILADELPHIA 46, PA.

SINCE 1899

Representatives in Boston, New York, Cleveland, Mobile, and Havana

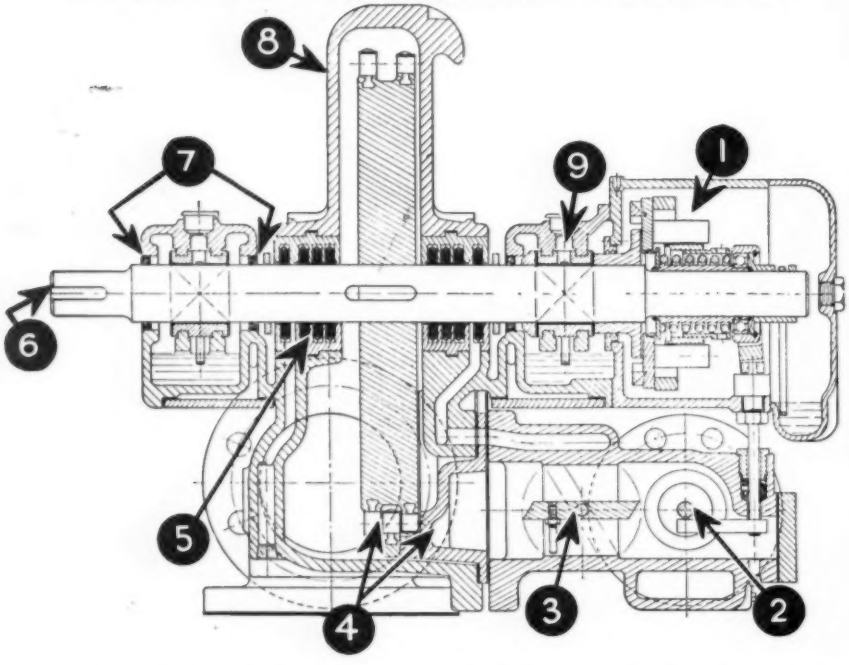
MITCHELL

PIPING FABRICATORS AND CONTRACTORS



MURRAY *TYPE-S*

SINGLE STAGE TURBINES FOR MECHANICAL DRIVE



1. Mechanical constant speed governor completely enclosed and fully lubricated. Heavy cast housing, removable for inspection. Provision for tachometer reading, by removing end plug.
2. Double seated balanced stainless steel governor valve, with stainless steel renewable seats. Corrosion resisting steam strainer ahead of control valves.
3. Separate emergency overspeed butterfly trip valve actuated by unbalanced weight type emergency overspeed governor.
4. Stainless steel blading and shroud band. Nozzles drilled and reamed in replaceable nozzle ring.
5. Carbon ring glands, stainless steel springs, corrosion resisting gland cases. Cast in leakoff reduces pipe fittings necessary.
6. Tapped hole in shaft end facilitates drawing on coupling.
7. Bearing seals effectively retain oil and exclude dirt and moisture.
8. Casing split at centerline allowing inspection without disturbing alignment or steam connections.
9. Sleeve type babbitt lined bearings with split oil rings, easily removable. Babbitt thrust faces against collars. Inspection covers and flush level glasses included. Water cooling always furnished.

FOR DEPENDABILITY, SPECIFY A MURRAY TURBINE

Bulletin T-121 gives complete details. Write for your copy today.

MURRAY IRON WORKS COMPANY

BURLINGTON, IOWA

Builders of Steam Power Equipment for Three Quarters of a Century

tral region with headquarters in Cleveland. (3) John G Fritzinger has been made assistant director of sales in eastern region, with headquarters in Philadelphia. (4) R R Huntington succeeds Fritzinger as district sales manager at Philadelphia. The above named appointees will function under F J Tone Jr, vice-president and general sales manager, and C E Hawke, director of sales.

Materials Handling Assn of Northern Calif. has elected Ray Perin, of Ira G Perin Co, for 35 years West Coast representative for Elwell-Parker trucks, president of the association.

H B Lammers has been named chairman of **Coal Producers Committee for Smoke Abatement.** R L Ireland has been elected vice-chairman and A L Brown executive secretary. Lammers succeeds R E Howe, president of Appalachian Coals, Inc. Howe resigned because of pressure of other work.

John R Mahon has joined **Armstrong Advertising Agency,** Chicago.

West Penn Power Co has appointed Gilbert D Burleigh superintendent of new Mitchell Station. Burleigh's **headquarters** are at Courtney in construction office of the station.

Fred B Wilson, assistant to president of **Georgia Power Co** since 1932, has resigned to devote his entire time to his other business interests.

Public Service Corp of N. J. has named William J Alexander director of safety education for Public Service companies, succeeding John M Orts who died on Nov 23.

New York Power and Light Corp has announced promotion of George L Johnson to resident manager of Hudson district and William M Pierson to Albany district commercial manager, succeeding Johnson.

Merritt-Chapman & Scott Corp 17 Battery Pl, New York City, has named Harold Olsen, superintendent of repairs.

OBITUARIES

Ralph Perry Ormsbee, 58, vice-president and director of Providence Steam Co., R. I., and of Narragansett Electric Co, Providence, died suddenly at Rumford, R. I., on Dec. 8.

John P George, 70, stationary engineer at Ruberoid Co, Erie, Pa., died recently in his home after a short illness.

David Berger, secretary-treasurer of Berger Bros Electric Motors, Inc, Rochester, N. Y., died on Nov. 24.

H Boyd Brydon, a member of staff of Byllesby Engrg and Management Corp, Chicago, (now Public Utility Engrg and Service Corp) for 21 years, retiring as chief mechanical engineer there in 1930,

COFFIN TURBO PUMPS

HIGH SPEED—SINGLE STAGE

2 No Destructive Casing erosion-corrosion

because:

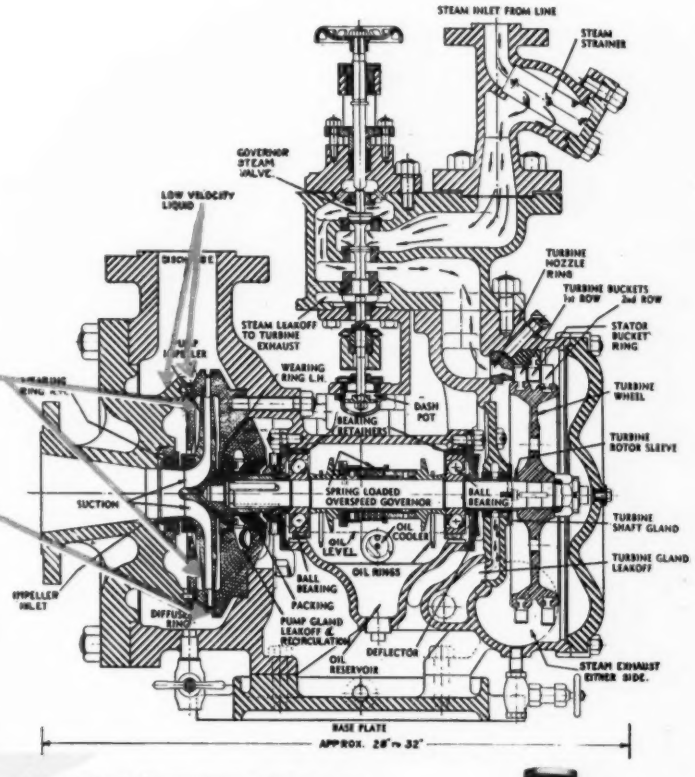
...erosion-corrosion rises sharply as fluid velocities increase. In COFFIN TURBO PUMPS, no high velocity liquid touches Pump Casing. (Note: Highly de-aerated pure feed water at high velocity attacks steel rapidly). The high velocity liquid in Coffin Pumps is inside a chamber formed by the Diffuser Ring, Pump Diaphragm and Impeller. These parts are made of non-corroding metal and are long lasting but if attacked can be renewed at relatively low cost. By the time the liquid has passed through the divergent diffuser passages and reaches the casing, it is at little more than pipe line velocity. Hence erosion-corrosion is insignificant and casings last indefinitely.

thus:

With this **DIFFUSER-DIAPHRAGM** construction, casing erosion-corrosion is unknown

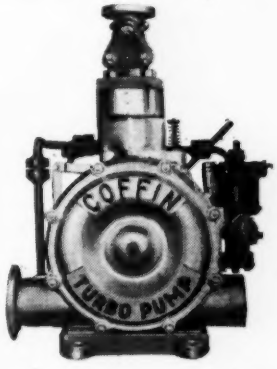
HIGH VELOCITY LIQUID

LOW VELOCITY LIQUID



UNIQUE FEATURES

1. Standardized Steam Turbine Centrifugal Pump and Governor Sets, individually engineered, assembled and tested . . . for IMMEDIATE SHIPMENT.
2. No destructive casing erosion-corrosion.
3. No interstage leakage.
4. Wide range exact pressure governing.
5. Loss of suction reduces speed without tripping; automatic speed recovery with suction restoration.
6. High efficiency pump plus high speed two-bucket row turbine result in minimum steam consumption.
7. Matched Pump, Turbine and Governors under one responsibility.
8. Exact hydraulic and mechanical balance—light weight rotor—large bearings; result: bearing troubles practically unknown.
9. Pump Gland Leakoff provides adequate recirculation; suction pressure only on packing.
10. Rigid one-piece steel casing plus heavy shaft plus ample clearances result in no damage from dry operation.
11. All parts made to gage and replaceable without fitting; all parts in stock at factory with wearing parts available from agencies' stocks.
12. Proved for performance over a period of more than twenty years in service.
13. Compact, light in weight, quiet and low in maintenance.

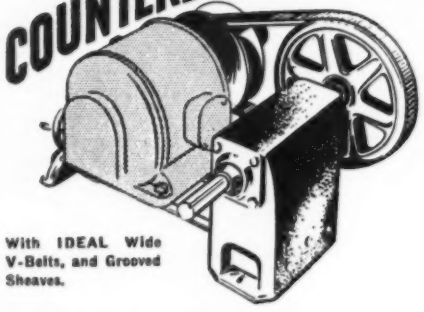


Literature sent on request, specific proposals on receipt of operating data.

INDUSTRIAL RAILROAD COFFIN MARINE PRODUCTS
FOUNDED 1925

The J.S.COFFIN, JR., CO. 328 South Dean St. ENGLEWOOD, N.J.

Complete
VARIABLE SPEED DRIVE
LOVEJOY IDEAL CHICAGO
COUNTERSHAFT UNIT



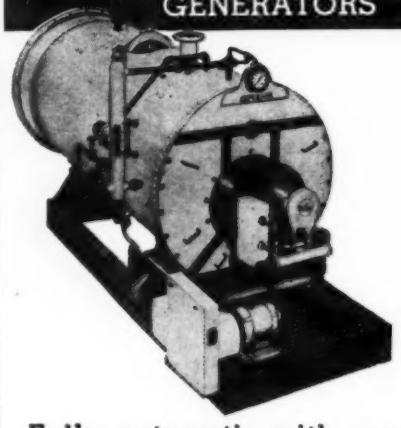
With IDEAL Wide V-Belts, and Grooved Sheaves.

- For thousands of uses where variable speed was formerly impossible.
- For speed-up or slow speed drives. 3:1 speed ratio.
- Multiple reduction. Applicable in space limitations.
- Accurate, instant finger-tip control of speeds.
- Five pulley sizes up to 8 hp.
- All metal. Non breakable steel sheave. Pressure lubricated.

SEND for IDEAL Catalog. Also shows Variable Speed Pulleys, "Select-o-Speed" Transmission, Wide, V-Belts, Adjustable Motor Bases, etc.

LOVEJOY FLEXIBLE COUPLING CO.
Mfrs. Lovejoy Flexible Couplings
WEST LAKE STREET CHICAGO 44, ILLINOIS

SUPERIOR
STEAM GENERATORS



Fully automatic with any grade of oil. 17 sizes from 20 to 500 b.h.p. for pressures up to 200 p.s.i. Require no expensive chimney, supply their own induced draft. 80% thermal efficiency guaranteed. Write today for catalog 101.

Superior Combustion Industries, Inc.
Factory: Emmaus, Pa.
Executive Offices: Times Bldg., Times Sq., N. Y.

D. W. HAERING & CO., Inc.
GENERAL OFFICES:
205 West Wacker Drive, Chicago 6, Illinois

died late in Nov at Victoria, B. C., Canada. He was one of the best-known amateur astronomers in Canada.

Herbert A Wagner, 80, former president and chairman of board of directors of Consolidated Gas Electric Light & Power Co, Baltimore, Md., died on Dec 5 at Union Memorial Hospital in Baltimore. Wagner had retired as chairman in 1943. He was president from 1915 to 1942.

Lynn Gillespie, 87, a retired stationary engineer, died at his home in Woodlawn Beach, N. Y., recently. Before he retired Gillespie served as a stationary engineer at Lackawanna plant of Bethlehem Steel Co.

Preston S Arkwright Jr, 44, president of Georgia Power Co, died unexpectedly at Georgetown University Hospital, Wash., on Nov. 6.

J H Walker, 58, vice-president of Detroit Edison Co, died at his home in Birmingham, Mich., on Dec 1 after a severe illness.

Ernest William Rudd, 64, a stationary engineer at North American Cyanamid plant in Niagara Falls, Ont., died recently at his home there following a brief illness. In the Nov issue it was erroneously stated that he was a member of the Stationary Engineers' Institute of Ontario. There is no such organization. Rudd was a member of the Institute of Power Engineers.

James F Lincoln arc-welding foundation trustees have announced the awards in its $200,000 design-for-progress program. The 467 awards range from $100 for honorable mention to $13,200 for the main award.

First main award of $13,200 was divided among Paul F Hackethal, chief engineer, Clarence C Mast, shop superintendent, and Douglas W Hamilton, welding foreman —all of aeromatic propeller dept, Koppers Co, Baltimore, Md., for their co-authorship of a paper entered in the aircraft classification. Their paper describes how welded design of a variable pitch propeller hub for light planes overcame problems presented by low-cost manufacture and strength requirements to withstand repeated loads of thrust torque, centrifugal pull and gyroscopic action. The second main award of $10,700 was awarded to Kiser E Dumbauld, design engineer, of Bureau of Bridges of Ohio State Highway Dept, for his paper in structural building and bridges classification. His subject was the redesign to welded construction of three of Ohio's bridges. The third main award of $8200 went to G J Storatz, engineer in charge, Heil Co, Milwaukee, Wis. His paper, entered in industry machinery classification, described redesign to welded construction of the company's *Trailbuilder*.

An addition to the No. 3 drum shop of Babcock & Wilcox Co was completed. This is part of previously announced expansion program. The addition, 275x100 ft, brings total length of shop to about 600 ft. This results in a substantially expanded area for fabrication of drums.

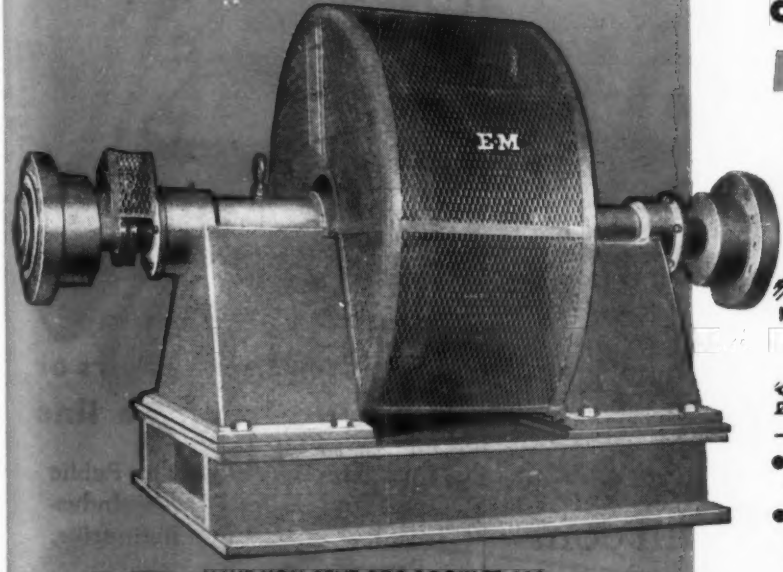
HOW TO GET ADJUSTABLE WIDE-RANGE PRECISE Speed Control FOR YOUR BOILER DRAFT FANS . . .

TODAY'S answer to how to get correct, economical speed control for boiler draft fans is the E-M *Magnetic Drive*. A compact, electro-magnetic torque-transmitting device, the *Magnetic Drive* is installed between a constant-speed motor and the fan, and operates in combination with automatic boiler draft control.

The result: *precise, quick-response, adjustable speed* of boiler draft fans from maximum speed down to 10% of motor speed.

The *Magnetic Drive* permits the fan to be operated at minimum speed for given output, reducing fan wear due to erosion, lowering power consumption and operating costs. Simple in construction, the *Magnetic Drive* uses no fluids which may produce dirt or fire hazards, requires no vane control of fans You get quick speed response, over the wide range of speeds. The *Magnetic Drive* is as ruggedly built and as dependable as a motor. See your E-M field engineer now about this newer, better method of boiler draft speed control.

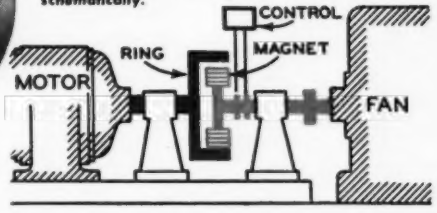
ELECTRIC MACHINERY MFG. CO.
MINNEAPOLIS 13, MINNESOTA



HAVE YOU SENT FOR BOOKLET 183 DESCRIBING THE MAGNETIC DRIVE

QUICK FACTS ABOUT THE Magnetic Drive

- The E-M Magnetic Drive is a simple, compact, electro-magnetic torque-transmitting device.
- It consists essentially of a ring, driven by the motor, and a magnet coupled to the fan, as illustrated schematically.

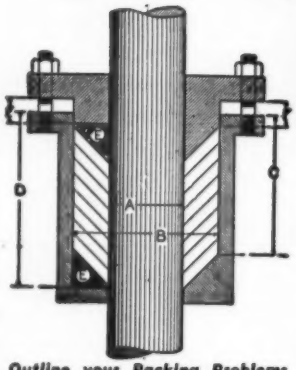


- Closely adjustable-speed from maximum down to 10% of motor speed . . . controlled electronically.
- Advantages: Precise fan speed control — Maximum fan power economy — Minimum fan wear from erosion — Quick speed response — Simple rugged construction.

E-M Adjustable-Speed MAGNETIC DRIVES

Pay for themselves through better boiler control, longer fan life, and power savings!

A2021



Outline your Packing Problems and Let us show you what "Q-P" Self Setting Packing can do for you.

Q-P *Self-Setting* PACKING

Q-P Self-Setting Packing has demonstrated its superiority under the most difficult conditions on land and sea and can be depended on to meet requirements for high maintenance economy. It is the ideal packing for superheated steam, saturated steam, hot and cold water, ammonia, fuel oil, compressed air, gases and acids and other operating conditions. (For Valves, Turbines, Diesels, Expansion Joints, Hydraulic Equipment, etc.).

THE Q-P MANUFACTURING COMPANY
NEEDHAM HEIGHTS 94, MASS.

Sales Representatives in Leading Cities from Coast to Coast

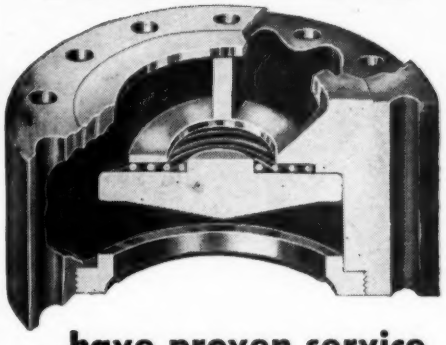
Diesel Engines

A SPECIAL SECTION

In its April issue, POWER will commemorate the 50th Anniversary of the American diesel engine with a comprehensive survey of modern engines. Watch For It!

"WATER HAMMER" CAUSING TROUBLE IN YOUR PLANT?

THE WILLIAMS-HAGER *flanged* SILENT CHECK VALVES



...have proven service records of more than 17 years without repairs or removal from the line

on Heavy Duty Service for Public Utilities, Water Works, Industrial Plants, Oil Refineries, Paper Mills, Chemical Works, Private and Public Buildings, Hospitals and other Institutions wherever dependability, economy and *silent operation* is essential.

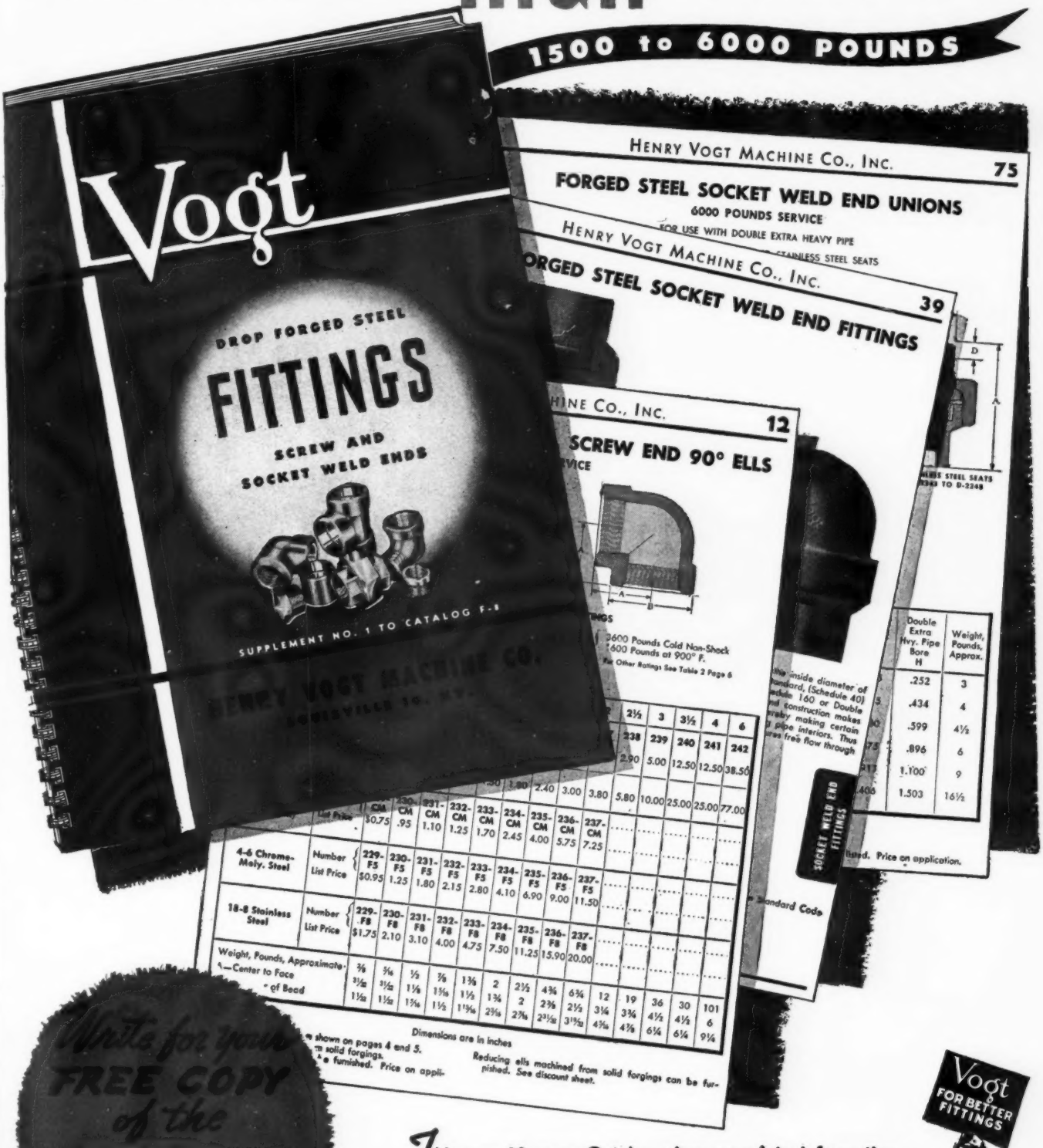
Write for new bulletin!

THE WILLIAMS GAUGE CO.

Pump Valves . . . Water Gauges . . . Gauge Cocks . . . Steam Traps . . . Pump Governors . . . Feed Water Regulators . . . Water Columns

2055 PENNSYLVANIA AVE. · PITTSBURGH (12), PA.

FIRST CHOICE FOR HIGH PRESSURE PIPING SYSTEMS

1500 to 6000 POUNDS

Write for your FREE COPY of the NEW FITTINGS CATALOG

This new 80 page Catalog gives complete information on carbon steel and alloy steel Fittings in sizes from 1/8" to 6", with pressures from 1500 lbs. to 6000 lbs., for oil, steam, water, air, or gas services. Alphabetical, Numerical and Pressure Indexes are designed to help users quickly find specific data.

HENRY VOGT MACHINE CO. • 1000 W. Ormsby St., Louisville 10, Ky.
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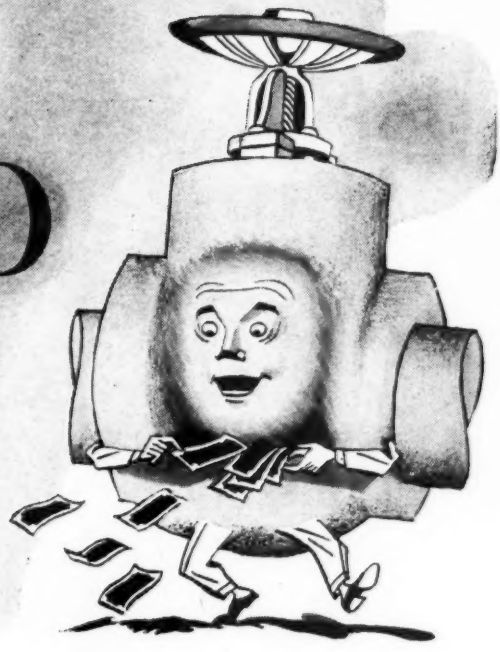
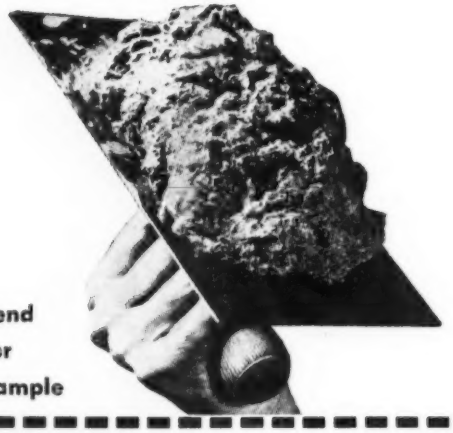
heat losses turn into profits



when you insulate with B-H No. 1 Cement



Send for Sample

Looking for ways to cut production costs? Then put B-H No. 1 Cement to work on valves and other irregular surfaces where BTU's are going to waste.

It goes on in a jiffy—simply add water, mix and apply. Sticks instantly on metal or brick—even on under-surfaces.

It stays on—doesn't crack or peel. Rust inhibitor prohibits pitting or corroding of metal surfaces.

It insulates up to 1800° F—because the base is black Rockwool. Just 3 inches of B-H No. 1 cement, for example, reduces 800° surface heat to 150° F.

It's convenient—no loss, breakage or waste. Packed in 50 pound bags ready for instant use. Reclaimable up to 1200° F. The coupon brings descriptive literature and a working sample.

Baldwin-Hill Company
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Send free sample of B-H No. 1 Cement and data book "Industrial Insulations."

NAME..... POSITION.....

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OTHER B-H INSULATION MATERIALS

B-H Mono-Block—an easy-to-apply, one-block insulation for temperatures up to 1700° F. **B-H Blankets**—for wrap-around insulation of large areas, effective to 1200° F. **B-H Weatherseal**—a weatherproof compound for protecting insulated surfaces.

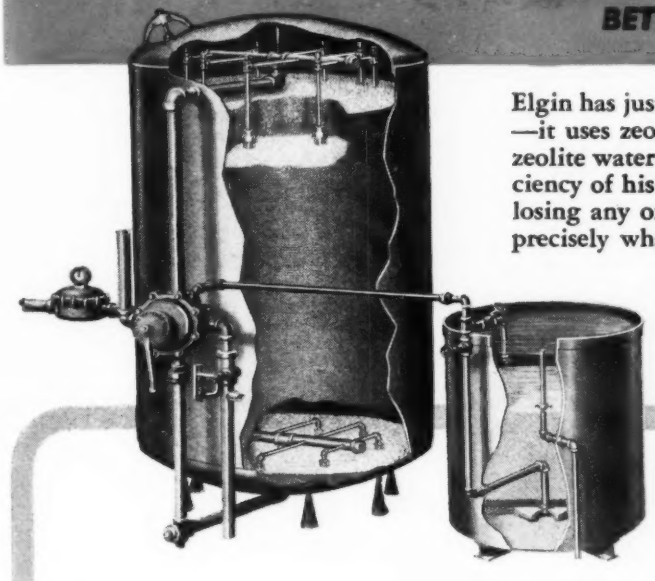
Baldwin-Hill

Specialists in Thermal Insulation

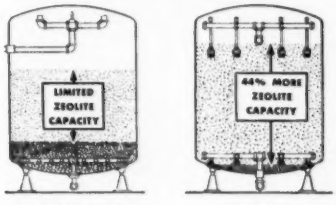
ELGIN WATER SOFTENER

Does more with Zeolite

. . . USES MORE OF IT . . . USES IT BETTER . . . NEVER LOSES ANY OF IT!



Elgin has just one thing in common with other zeolite water softeners —it uses zeolite. That's where the similarity stops. Any maker of a zeolite water softener could increase the capacity and improve the efficiency of his softener *if* he could increase its zeolite contents without losing any of the zeolite during the backwashing operation. This is precisely what Elgin does—and no one but Elgin!



ORDINARY DESIGN — ELGIN DESIGN

SAME SIZE UNITS . . . SAME TYPE ZEOLITE

. . . UP TO 44% MORE SOFT WATER . . . THE ELGIN "DOUBLE-CHECK" DESIGN DOES IT! . . .

In the first place, the Elgin *does more* with its zeolite because it uses *all* the zeolite. Its manifold is designed to distribute the water and the regenerating brine over the entire zeolite bed instead of over a portion only as in other softeners. This means that all the zeolite is used. There are no by-passed, no "dead" zones.

Next, Elgin uses *more* zeolite. Other softeners are sharply limited in the depth of the zeolite bed they can handle. Why? Because they contain no mechanism to prevent zeolite being washed down the drain during backwashing. The deeper the zeolite bed, the greater the risk of such loss. Therefore, other softeners must resort to a shallower zeolite bed and a slow, consequently inefficient, backwash rate.

Elgin's ingenious "Double-Check" arrangement of automatic valves is the only system which permits dirt and sediment to get to the drain but prevents the loss of zeolite. Further, a *fast* backwash rate can be used, assuring a thorough cleansing and conditioning operation that means better regeneration.

Elgin can and does (see diagram) use more zeolite, size for size—and uses it more efficiently. This means greater water-softening capacity, up to 44% more. And no zeolite is lost—therefore, expensive zeolite replacements are virtually eliminated.

Yes, Elgin does far more with zeolite. This is why it is the world's most effective water softener, a constant money-saver year in and year out.

★ **Get 3 to 10 Times as Much Soft Water From Your Present Softener . . .**

You can do this by modernizing your present softener with Elgin "Double-Check" manifolds plus Elgin high-range capacity zeolites.

FOR COMPLETE DETAILS, SEND FOR BULLETIN 607

Elgin has an economical solution to every water treatment need.

1. Elgin Boiler Feedwater Treatment . . . individually prescribed based on plant survey; specifically formulated and guided by laboratory and field service.
2. Elgin Post Treatment for softened water. When fed to boilers, softened water (either zeolite or lime-soda) needs Elgin Post Treatment to guard against corrosion and the effects of condensate contaminated with hard water.
3. "Elgex" Corrosion Prevention Treatment—for steam and condensate systems. Small amount does big job at low cost.
4. Elgin Inhibitant Treatment—remarkable in preventing and eliminating scale in hard water lines, condensers, cooling systems, boiler feed lines, pumps, heaters, etc.
5. Elgin Anti-Corrosion Treatment for hot and cold water lines—including distribution systems, process lines, etc. Establishes protective film which prevents corrosion.

When requesting information, please specify kind of treatment.

ELGIN SOFTENER CORPORATION

130 NORTH GROVE AVENUE, ELGIN, ILLINOIS • REPRESENTATIVES IN PRINCIPAL CITIES

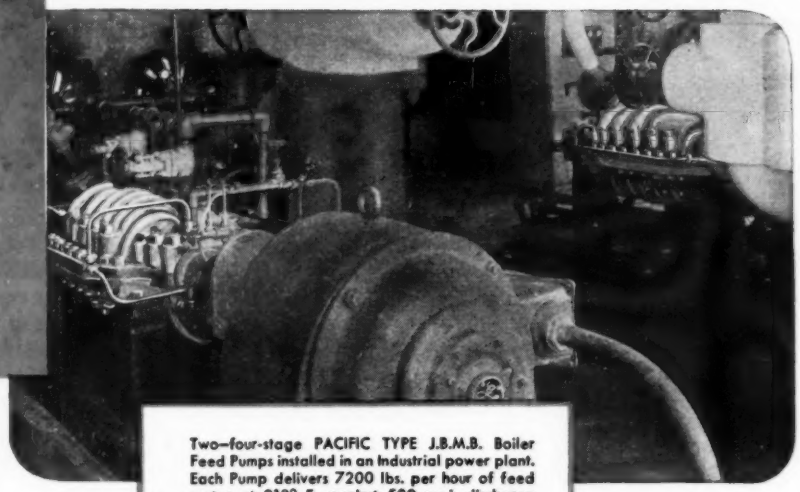
SOFTENERS ★ FILTERS ★ WATER TREATMENT ★ BOILER WATER CONDITIONING

Your PACIFIC TRIO

TYPES I-A-JB

Precision Built

For DEPENDABLE—UNINTERRUPTED BOILER FEED SERVICE IN POWER PLANTS—LARGE OR SMALL

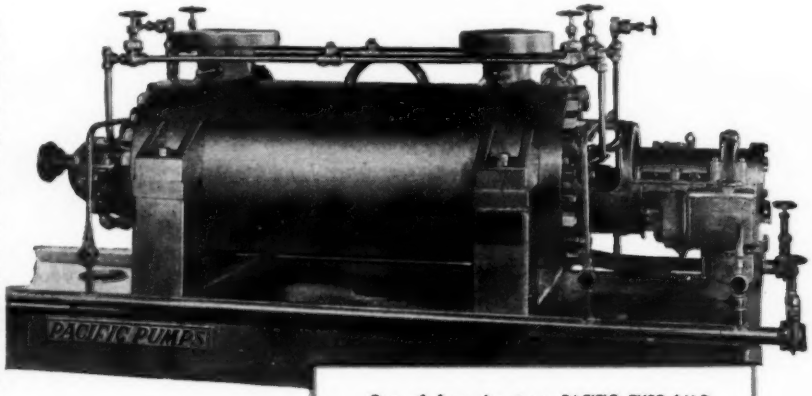


TYPE JB ➤ Two-four-stage PACIFIC TYPE J.B.M.B. Boiler Feed Pumps installed in an industrial power plant. Each Pump delivers 7200 lbs. per hour of feed water at 212° F against 500 p.s.i. discharge pressure.

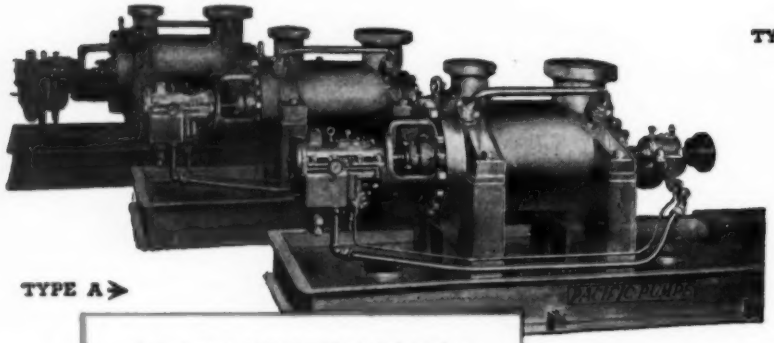
EXPERIENCE ★ For 23 years PACIFIC have designed and built centrifugal pumps for high-pressure–high-temperature service. The knowledge of this experience is incorporated in the PACIFIC TRIO–TYPES "I"–"A"–and "JB" Boiler Feed Pumps.

1925 ★ The first PACIFIC Centrifugal Pumps for High Pressure–4 units each for 180,000 lbs. per hour–175° F.–2100 p.s.i. discharge. Design featured RING TYPE JOINTS–METAL-TO-METAL SEAL to prevent interstage leakage, SUCTION PRESSURE on both Packing Boxes.

1925 to 1948 ★ a period of refinement. Included was the PACIFIC "Floating Seal"–a simple, effective pressure break-down and balancing device, making possible for PACIFIC in 1943 to build pumps to deliver 325,000 lbs. per hour of water at 545° F. against 1388 p.s.i. discharge pressure.



TYPE I ➤ One of four nine-stage PACIFIC TYPE I.M.B. Boiler Feed Pumps shipped in October 1947 for a large central station. Each pump to deliver 657,600 lbs. per hour of feed water at 220° F. against 1700 p.s.i. discharge pressure.



TYPE A ➤ Three six-stage PACIFIC TYPE A.M.B. Boiler Feed Pumps now being installed in a municipal power plant. Each pump to deliver 200,000 lbs. per hour of feed water at 287° F. against 1,000 p.s.i. discharge pressure.

DESIGN ★ embodies features proved in service–dynamic–radial and axial balance–ring-type high pressure joints–positive seal against interstage leakage–low pressure on Packing Boxes.

MATERIALS ★ the right materials for the service, Cast Steel Cases for medium pressures, forged Steel Cases for high pressures; (when necessary steel cases may be lined with 18-8). Interior parts fabricated from Chrome Alloy Steels to prevent erosion and corrosion.

APPLICATION ★ Pacific's Engineers are available to assist you in selecting from the PACIFIC TRIO the right pump for your service.

PACIFIC PUMPS INC.

HUNTINGTON PARK, CALIFORNIA

One of the Dresser Industries

PACIFIC *Precision Built* PUMPS

BF-1

Offices in All Principal Cities–Export Office: 122 E. 42nd Street, New York City

Time-tested...

ACCURACY

BUILT INTO EVERY

HAYS-COCHRANE *friction-free* Electric FLOW METER

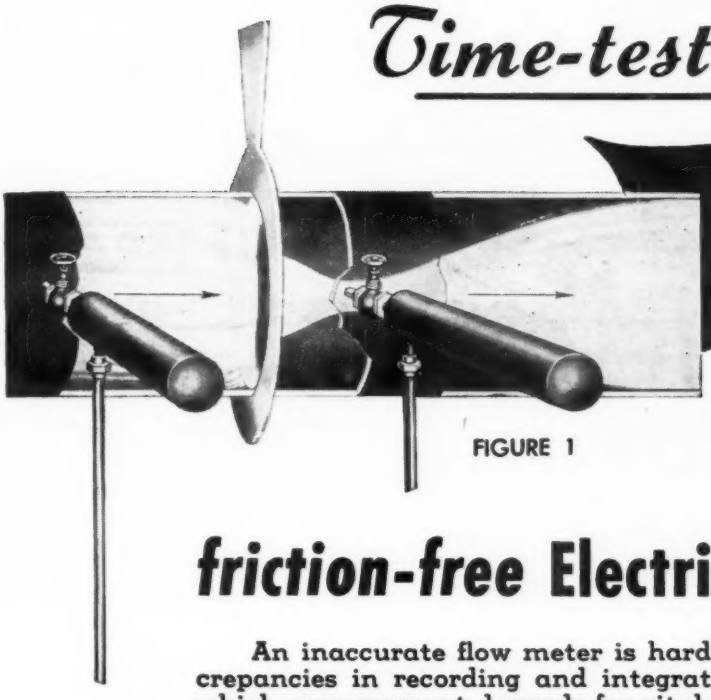


FIGURE 1

An inaccurate flow meter is hardly better than a good guess. Even slight discrepancies in recording and integrating flow can make valueless the records on which management depends for vital data.

In the Hays-Cochrane meter high accuracy is achieved by eliminating as much friction as is humanly possible and by applying sufficient power to compensate for the small amount of friction remaining.

The H-C transmitter (Figure 2) contains a mercury U-Tube, a non-metallic float on the mercury in the high pressure leg, two reactance coils, and a magnetic core supported by the float and positioned by differential pressure produced by orifice, nozzle or venturi in the pipe line (See Figure 1).

The Receiver (Figure 3), like the transmitter, contains two reactance coils and a core. A change in flow produces differential pressure change which moves float and core on the mercury surface of the Transmitter. Reactances of transmitter and receiver coils are thus unbalanced and a current flows through the galvanometer in the receiver, deflecting its boom. Indicator pointer, pen arm and integrator simultaneously show flow rate changes. This is accomplished with movement of the receiver core through a synchronous-motor-operated mechanical relay, which causes the galvanometer to regain null balance.

FIGURE 2
TRANSMITTER

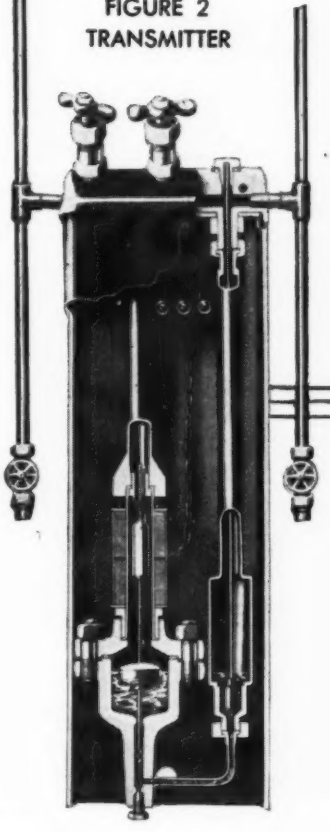


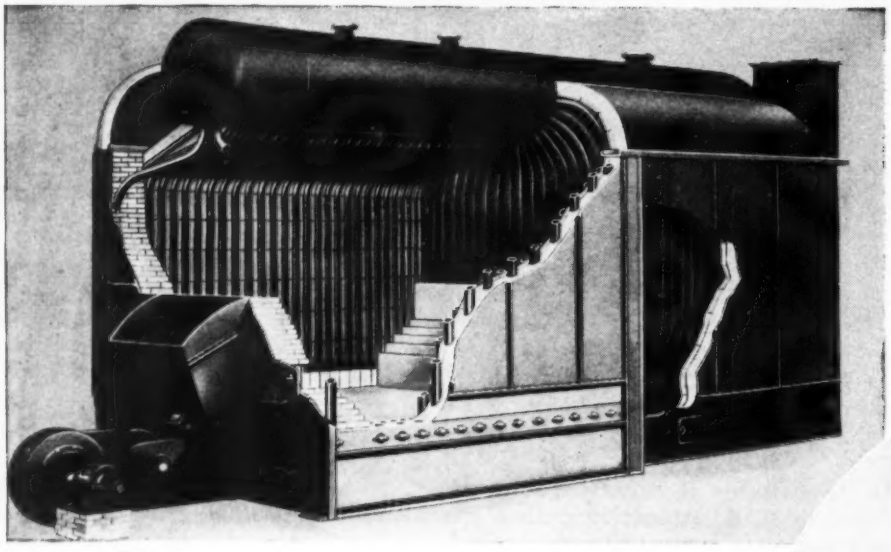
FIGURE 3 RECEIVER

There is no possibility of friction in the Hays-Cochrane Transmitter because there are no stuffing boxes, bearings, linkages or gears—merely a free-moving float positioning a core within a magnetic coil. The detecting circuit is not required to move any working parts other than the finely balanced galvanometer boom. These (indicating, recording and integrating mechanisms) are operated by a synchronous motor.

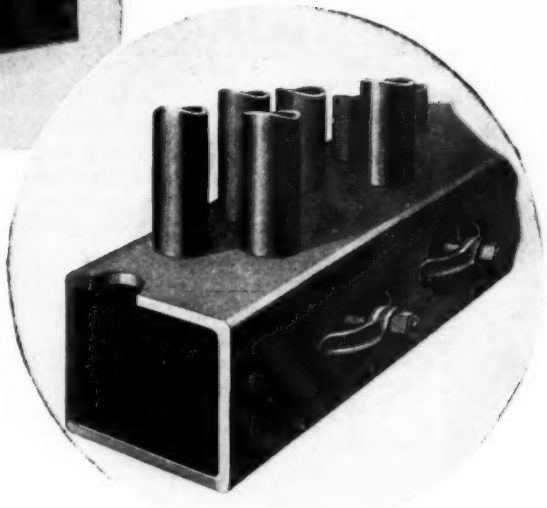
The HAYS CORPORATION
SINCE 1901
COMBUSTION INSTRUMENTS AND CONTROL
MICHIGAN CITY, INDIANA, U.S.A.

COMBUSTION CONTROL • GAS ANALYZERS • CO_2 RECORDERS • DRAFT GAGES

TYPE-VL *A Low Headroom*
2-DRUM WATER WALL BOILER



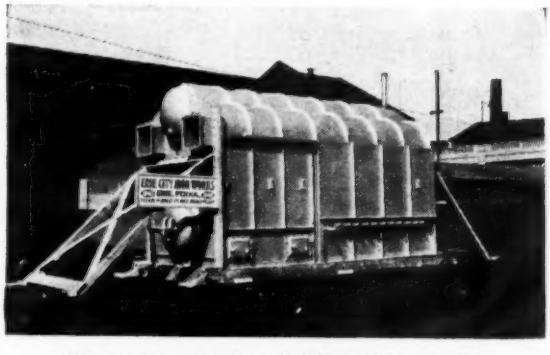
SHIPPED BUILT-UP IN SIZES TO 300 H. P.



Water Wall tube arrangement—1 Downcomer for each 2 Riser Tubes

Clean, Quiet, Circulating Water Taken From Top Drum

BACKED by a long experience gained in the manufacture of over 500,000 H.P. of Erie City 2-drum water tube boilers and of thousands of complete built-up boiler units, Erie City has incorporated side wall water cooling as an integral part of a low headroom 2-drum boiler. Outstanding of many features, is the method of obtaining a ring flow circulation, in each side wall element. A downcomer tube is provided for each pair of radiant (riser) tubes in the side wall, which, with two front wall downcomers assure an ample supply of clean circulating water in the water walls at all times. Insulation between riser and downcomer tubes keeps water at lower temperature in the downcomers while heat is rapidly removed from refractory through risers. Write for VL bulletin that clearly describes and illustrates this and many other features.



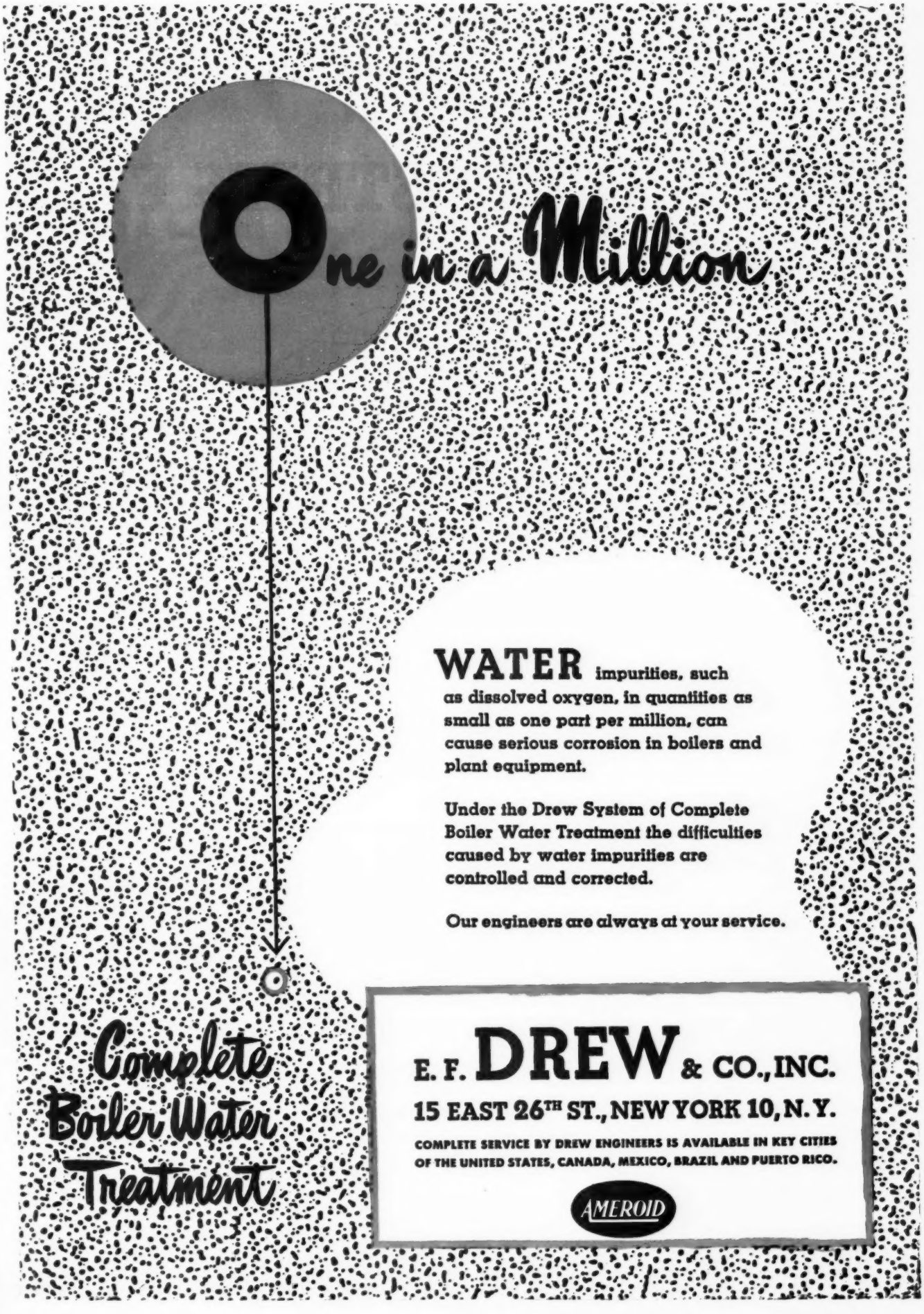
Shop assembled and shipped as a unit in sizes to 300 H. P.

COMPLETE STEAM POWER PLANT EQUIPMENT

ERIE CITY

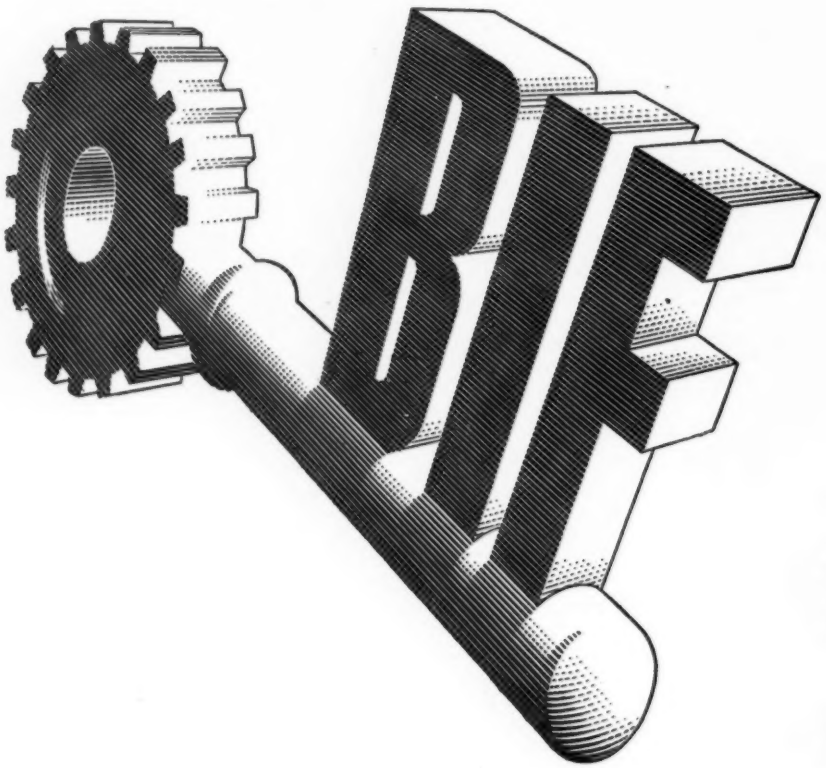
Complete Steam Generators • Type C 3-Drum Boilers • Type VL 2-Drum Boilers • The "Economic" Boiler with or without Water Walls • Welded H. R. T. Boilers • Welded Steel Heating Boilers • Coal Pulverizers • Underfeed Stokers and Welded Pressure Vessels for the Process Industries.

ERIE CITY IRON WORKS • ERIE, PA. • *Since 1840*


One in a Million
WATER impurities, such as dissolved oxygen, in quantities as small as one part per million, can cause serious corrosion in boilers and plant equipment.
Under the Drew System of Complete Boiler Water Treatment the difficulties caused by water impurities are controlled and corrected.
Our engineers are always at your service.
Complete Boiler Water Treatment
E. F. DREW & CO., INC.
15 EAST 26TH ST., NEW YORK 10, N. Y.
COMPLETE SERVICE BY DREW ENGINEERS IS AVAILABLE IN KEY CITIES OF THE UNITED STATES, CANADA, MEXICO, BRAZIL AND PUERTO RICO.
AMEROID

LONDON *and* BIRMINGHAM

BRITISH INDUSTRIES FAIR



1948

MAY 3-14

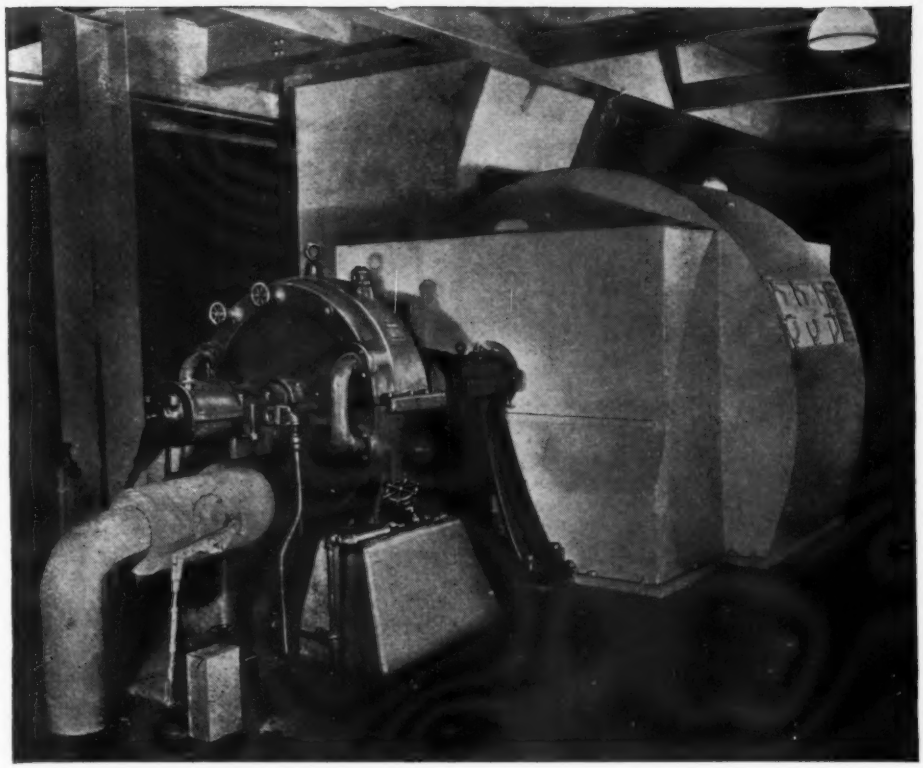
ON May 3rd 1948, when the British Industries Fair opens, buyers from all over the world will have an opportunity of inspecting the products of 3,000 United Kingdom manufacturers.

This annual event is the world's largest national trade Fair. Such is its size and importance that you are urged to *come yourself.* You are assured of personal contact with actual manufacturers or sole selling agents and you will find exhibits carefully grouped by trades so that comparisons may be made quickly. Above all you will see new achievements, new methods of manufacture and new ideas all executed with superb craftsmanship.

This is your only opportunity in 1948 to review within a few days the achievements of 87 United Kingdom industries.

For information and assistance you should apply to the nearest British Embassy, Legation or Consulate.

AIR EQUIPMENT TO HELP YOUR BUSINESS



FANS by "Buffalo"

EQUIPMENT FOR

- ★ VENTILATING
- ★ HEATING
- ★ COMFORT COOLING
- ★ PROCESS COOLING
- ★ AIR TEMPERING
- ★ AIR WASHING
- ★ EXHAUSTING
- ★ BLOWING
- ★ FORCED DRAFT
- ★ INDUCED DRAFT
- ★ PRESSURE BLOWING
- ★ CLEANING
- ★ DRYING

BUILT-IN STAYING POWER

for *Power Plant Fans*

"BUFFALO" Forced Draft, Induced Draft and Cinder Eliminating Fans are built RUGGEDLY. Rotors and housings are heavy steel plate hot-riveted together for stiffness and strength. Bearings and shafts are extra heavy. To facilitate installation and maintenance all parts of the housings are readily disassembled.

BUFFALO EFFICIENCY FEATURES

Maintenance savings are carried through in continuous delivery of more air for your money! "Buffalo" blades are shaped for the highest efficiency — rotors are fully balanced for vibrationless performance. And you can pick the most economical sized fan for the job — the "Buffalo" range is complete. Write for data now!

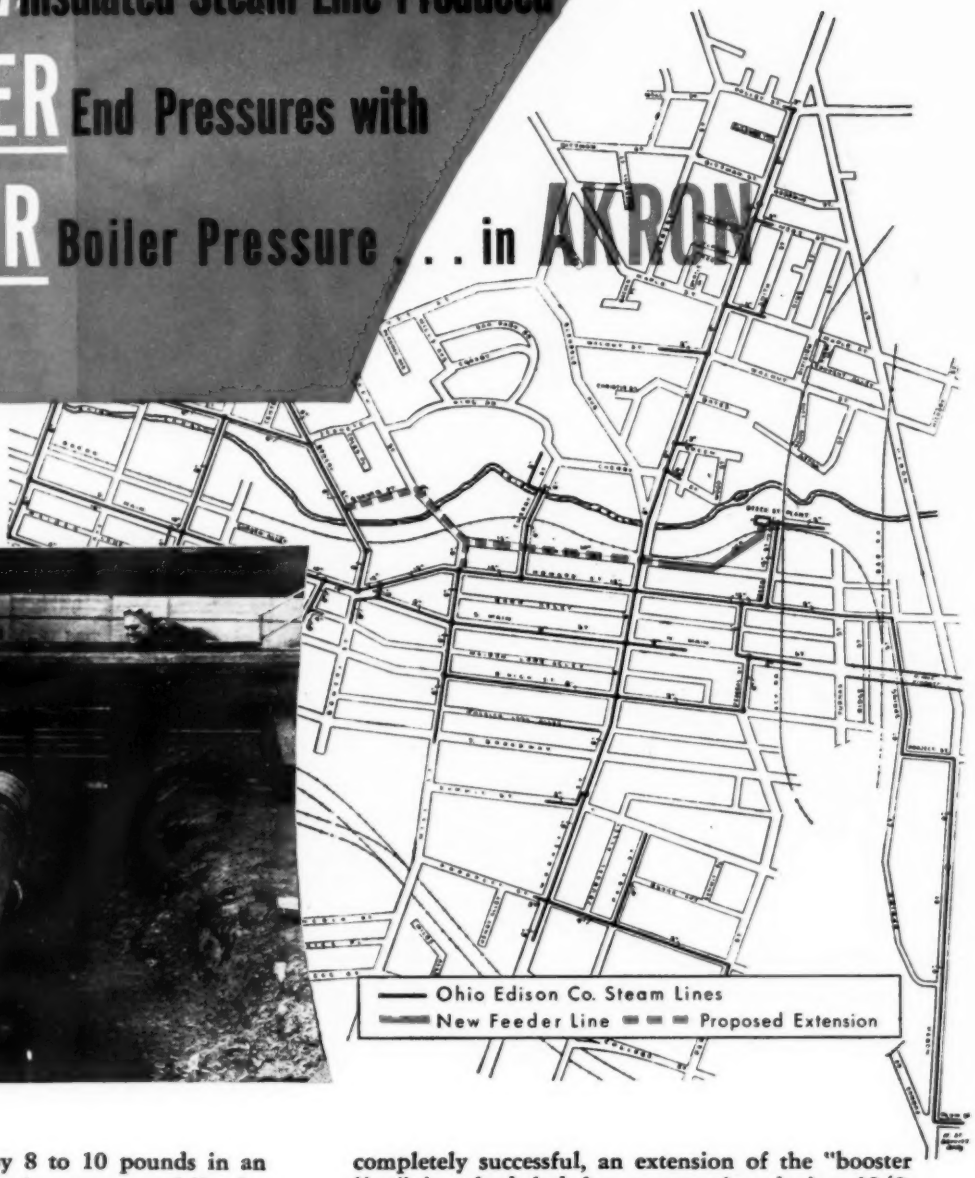
BUFFALO FORGE COMPANY

488 BROADWAY BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

CUTTING AIR COSTS IN EVERY BRANCH OF INDUSTRY

This RIC-WIL Insulated Steam Line Produced HIGHER End Pressures with LOWER Boiler Pressure . . . in AKRON



Increasing end pressures by 8 to 10 pounds in an underground steam distribution system while decreasing pressure by 25 pounds at the boiler plant may sound paradoxical . . . but that's just what the Ohio Edison Company accomplished in Akron.

The capacity of the system's main feeder, which carries 600 million pounds of steam annually to 422 customers, was being taxed severely to maintain required pressures at several end points during peak periods.

To solve this problem, Ohio Edison installed an additional feeder tieing into the system at a point 800 feet from the boiler plant. When it was cut into service, pressure at the boiler plant was reduced from 185 pounds to 160 pounds while end pressures increased 8 to 10 pounds.

As a result, the Company is able to offer service to additional customers in those areas. The "booster line" also assures uninterrupted service even when the main feeder from the boiler plant is cut out for inspection or repair. The installation has been so completely successful, an extension of the "booster line" is scheduled for construction during 1948.

Ric-wiL Pre-fabricated Insulated Pipe Units were specified for this job because of their high thermal efficiency and dependability . . . because they could be installed in shallow trenches with as little as 18 inches of cover . . . because several 21-foot units could be welded above ground and jacked under railroad tracks without interrupting train service . . . and because the ease of handling effected considerable savings in installation time and cost.

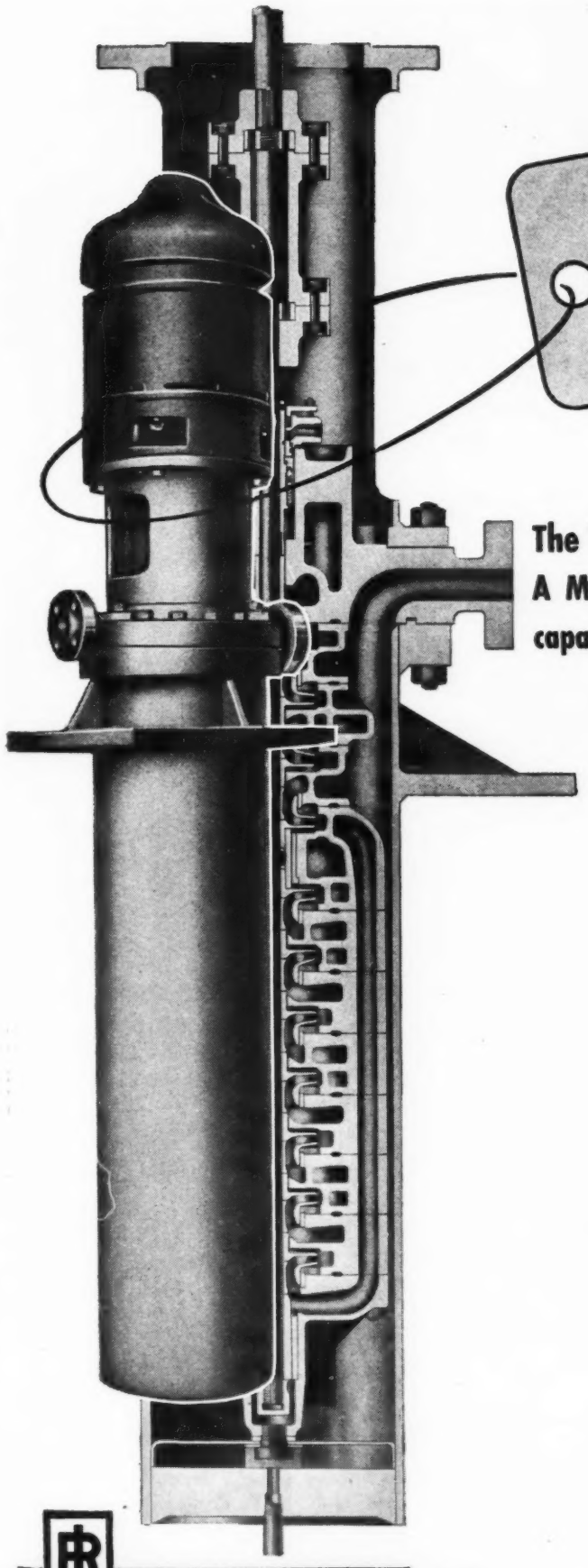
For more complete information on Ric-WiL Systems send for folder, Form 4708. Write Ric-wiL Dept. 582.

RIC-WIL

INSULATED PIPE CONDUIT SYSTEMS

THE RIC-WIL COMPANY • CLEVELAND, OHIO

CABLE ADDRESS: RICWIL, BENTLEY'S CODE



Built to your Specifications

The VHT and VHTA Vertical Boiler-Feed Pumps A Must where high pressure and low capacities are needed

The VHT and VHTA units were developed to meet the demand for centrifugal pumps to efficiently handle low capacity, high pressure, pumping jobs.

They have proven themselves to be reliable, sturdy, and well designed pumps.

Internal bearings carry radial loads only; any thrust load developed is carried by the driver. The internal bearings are constantly lubricated by the liquid being pumped. The single stuffing box may be arranged for bleed-off, cold-oil circulation through the packing, or solid packed as the service may require.

Both the VHT and VHTA are multi-stage vertical units with opposed impellers. The pumping elements are made up of sections and as many may be used as necessary to produce the desired head.

Where high pressure, high efficiency and low capacity are desired and where floor space is at a premium, THIS is the pump for the job.

Ask an I-R engineer for further details.

CAMERON PUMP DIVISION

AIR TOOLS • ROCK DRILLS
COMPRESSORS • TURBO BLOWERS
CENTRIFUGAL PUMPS • CONDENSERS
OIL AND GAS ENGINES

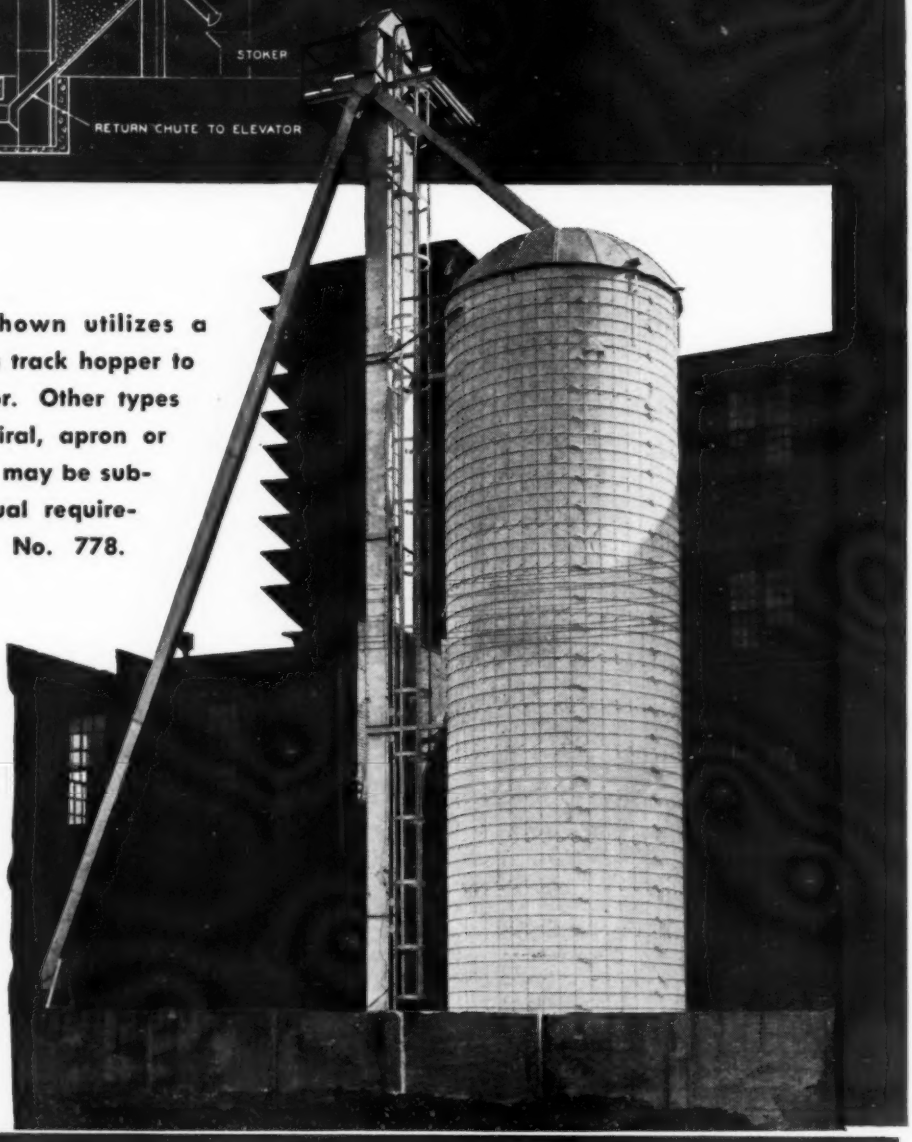
Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y.

68-10

LARGE CAPACITIES MINIMUM SPACE

Arrangement shown utilizes a plate feeder from track hopper to the bucket elevator. Other types of feeders . . . spiral, apron or electric vibrating . . . may be substituted to fit individual requirements . . . Catalog No. 778.



SILO STORAGE SYSTEMS

THE JEFFREY MANUFACTURING COMPANY

93-99 North Fourth St., Columbus 16, Ohio

ESTABLISHED 1877

Complete Line of Material Handling, Processing and Mining Equipment

Thicknesses from 1/64 to 1/4 inches.
Sheets 40 x 40 inches and larger.

Feeding mix for GARLOCK 7021 into sheeters at Garlock factory.

For Extreme Pressures

AND HIGH TEMPERATURES

GARLOCK 7021 Compressed Asbestos Sheet Packing was specially developed by Garlock for severe oil service. It is strong and tough, yet resilient. Gaskets cut from GARLOCK 7021 give superior service on pipe lines and other equipment handling gasoline, oil, gas or steam at extreme pressures and high temperatures.

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK
In Canada: The Garlock Packing Company of Canada Ltd., Montreal, Que.

GARLOCK 7021

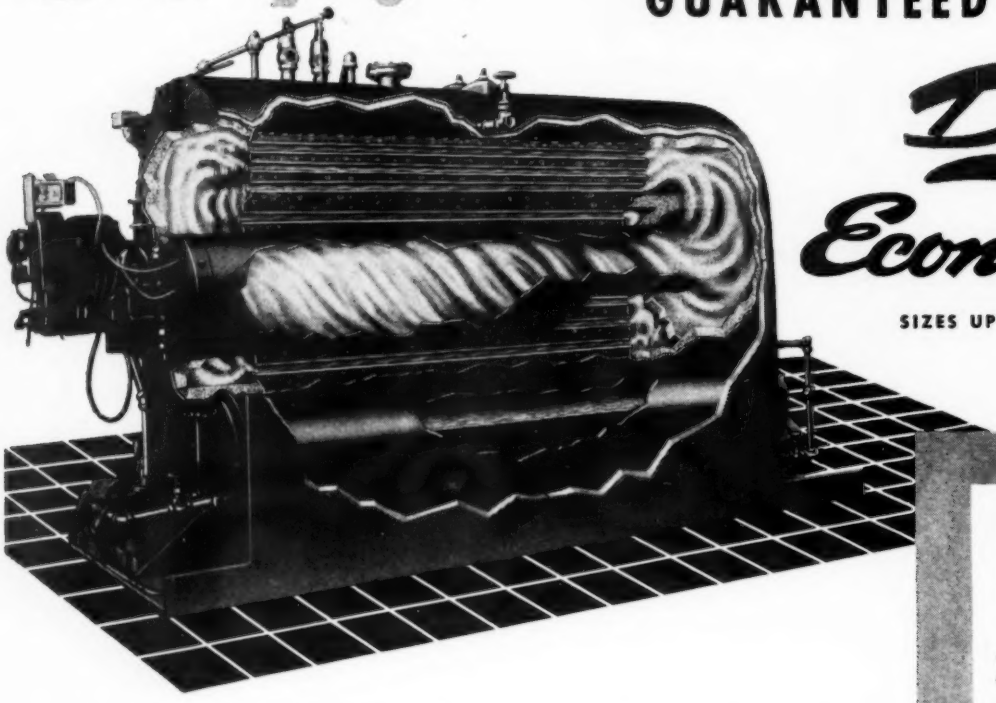
COMPRESSED ASBESTOS SHEET PACKING

80% OVERALL OPERATING EFFICIENCY

GUARANTEED WITH THE

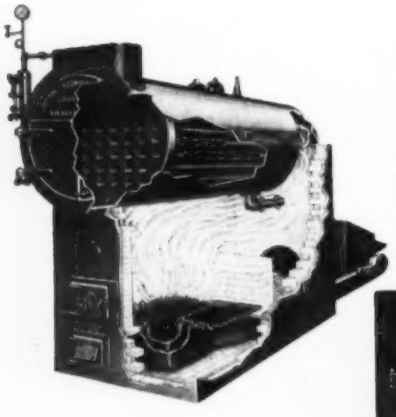
Dutton EconoTHERM

SIZES UP TO 160 HORSEPOWER



A completely self-contained package unit with controls, water make-up system and all other operating equipment installed at the factory, the Dutton Econotherm offers twice the power in half the space of a conventional boiler. Every size of Econotherm evaporates 7 lbs. of steam per hour per square foot of heating surface. Because Econotherm is shipped ready to operate, installation costs are extremely low. No large chimney or smoke stack is required.

Remember, a new Dutton Econotherm will more than pay for itself in increased efficiency over your old, worn out boiler. Get the facts on Econotherm's lower installation and operating costs for both new and replacement uses. Write today for complete details and specifications.

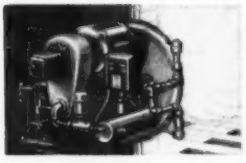


Stoker-fired

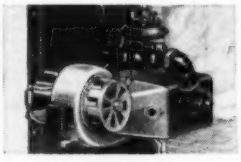
DUTTON EconoMIST

CAN BE CONVERTED TO ANY FUEL OVERNIGHT

A highly efficient Package Type HRT Boiler with insulation and refractory locked into steel casing. Assembled on skids and shipped ready for firing on arrival. Complete with burner, controls and feed pump system. Oil or gas burner installed in firebox above permanent grates designed for hand or stoker firing for quick conversion. Sizes up to 110 horsepower. Write for complete details and specifications.



Oil-fired



Gas-fired

The Burner in the Dutton Econotherm is set off-center. This speeds up water circulation . . . makes temperature constant throughout shell . . . is more efficient than center firing.

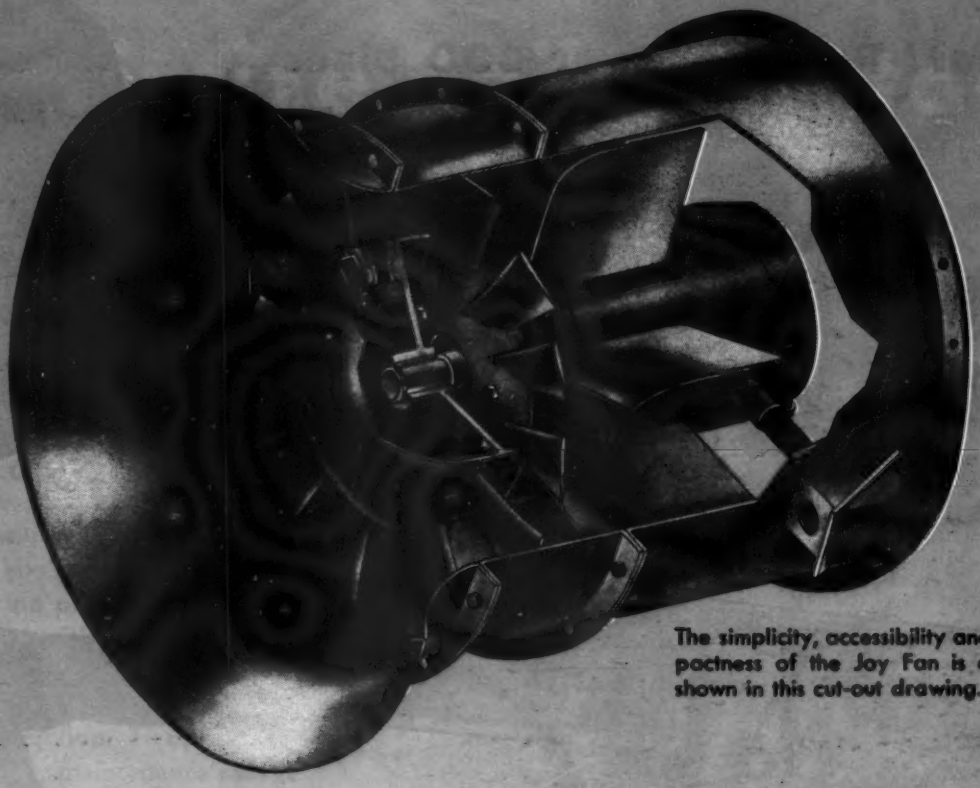
Dutton Water Level Control holds water level variation to within ¾". No surges of cold water to reduce temperature. No bent or cracked tubes from low water level.

Dutton Induced Draft Fan plus Three Pass Design insures more complete burning of fuel and more complete extraction of heat from burning gases.

Dutton Rotary Combustion whirls the air and fuel mixture violently in the combustion chamber mixing them more thoroughly and breaking down fuel particles to smaller size for more efficient burning.

THE C. H. DUTTON COMPANY

622 GIBSON STREET • KALAMAZOO, MICHIGAN



The simplicity, accessibility and compactness of the Joy Fan is clearly shown in this cut-out drawing.

"SERIES 1000"

JOY AXIVANE FANS

TROLLER DESIGNED

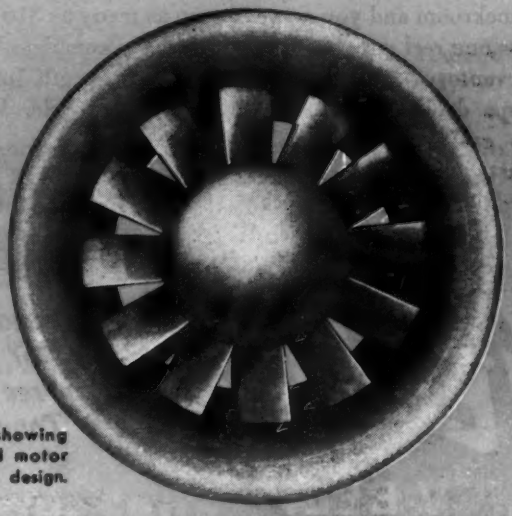
More efficient—lighter—more compact—easily and economically installed.

A very complete line of stock Vaneaxial fans in sizes and capacities to cover practically any industrial need.

Volumes up to 100,000 C.F.M.
Pressures up to 9.6" W. G.
Housing diameters 18" to 60".

Compact—easier to install—efficient—with an exclusive Joy feature, on-the-job adjustable Blades, permitting change of pressures and correction of duct resistance.

Write for Bulletin describing the "Series 1000" line—now ready!



Front view, showing self-enclosed motor and clean-cut design.

Call for a Joy Engineer

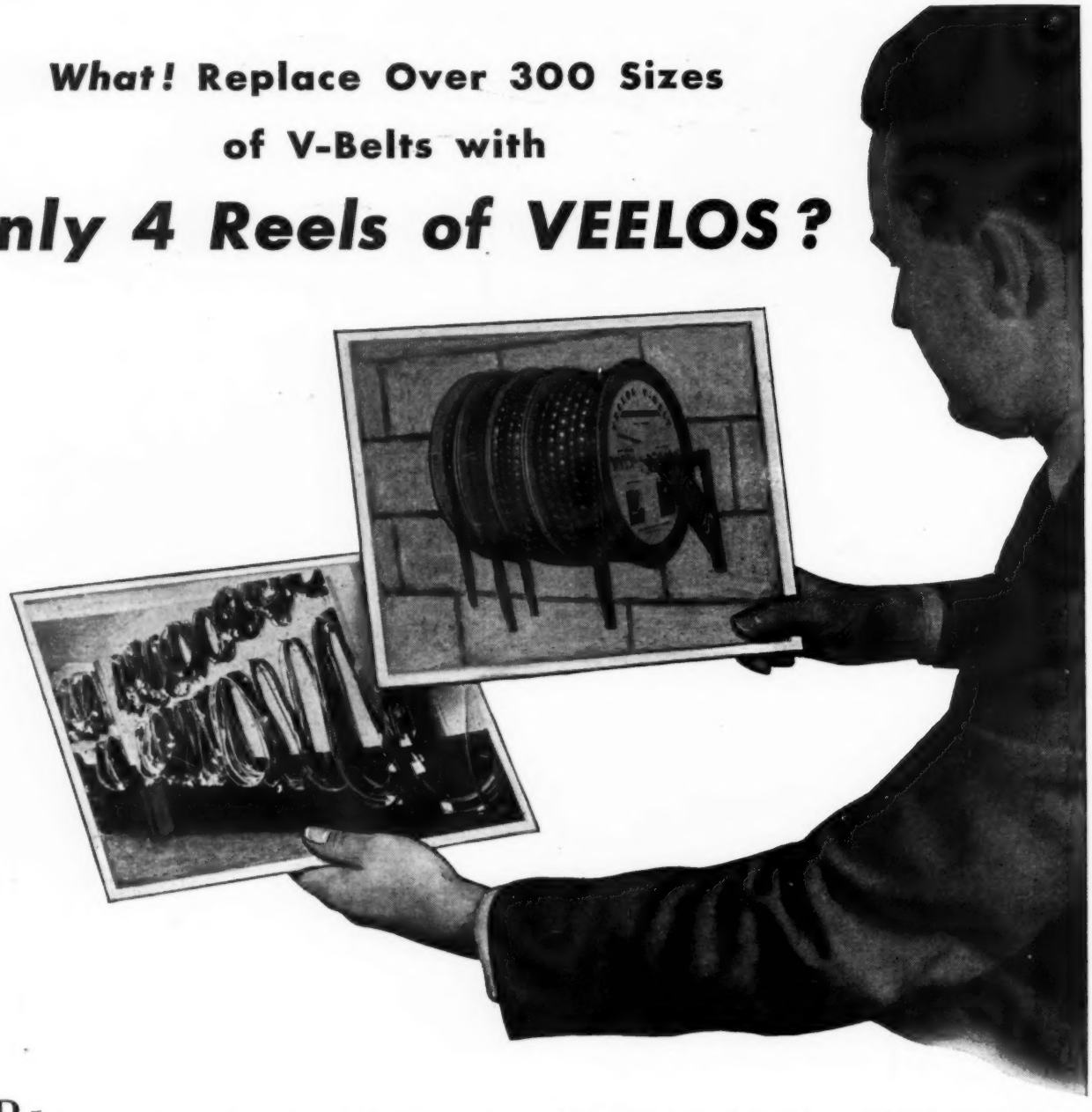
W & D

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

What! Replace Over 300 Sizes of V-Belts with

Only 4 Reels of VEELOS?



Put four reels of Veelos, the link V-belt, into your stockroom and you can make up as many as 316 sizes. Or one reel may be all *you* need for a complete V-belt inventory. Belt replacements of *any* length for *any* type drive are always immediately available. Veelos is easily uncoupled and made endless . . . saves installation time.

When you buy Veelos on reels, you end costly V-belt inventory. No need to stock spare sets of belts for each size drive. Obsolescence and deterioration are eliminated. Stock records are simplified. Standard reels of Veelos hold 100 feet . . . save storage space.

Veelos is available in all standard sizes, fits all standard grooves.

Sales engineers located in principal cities; over 300 distributors throughout the country.

VEELOS
THE LINK
V-BELT

Send for Free Copy

NEW VEELOS CATALOG describes 14 distinct advantages of Veelos. Page after page of pictures show Veelos at work in a wide variety of industries. All the facts and full engineering data are given.

MANHEIM MANUFACTURING & BELTING CO.
MANHEIM, PENNSYLVANIA

VEELOS is known as VEELINK outside of the United States

ADJUSTABLE TO ANY LENGTH • ADAPTABLE TO ANY DRIVE

Minimize Boiler Outage

with STRONG SCOTT UNIT PULVERIZER

simple, rugged design and constant firing

● When you need continuous steam production, you'll appreciate the constant direct-firing of STRONG-SCOTT Unit Pulverizers with any grade of coal, wet or dry. Boiler outage is held to a minimum because of simple design and rugged construction. Here are five good reasons why maintenance outage is so low:

1. Rotor-blades and fan-blades are of such simple design you can replace them easily and quickly.
2. Rotor cannot clog or jam because moving parts do not touch coal. Wide clearance safeguards it from damage from fuel lumps, tramp iron, etc.
3. Because dormant fuel forms lining of pulverizer chamber, wearing parts are protected and last longer.
4. ALL maintenance is done *outside* the furnace without special tools.
5. Only *one* motor runs entire unit.

Cut-away view illustrates the sturdy simplicity of the STRONG-SCOTT Unit Pulverizer. Reblading the rotor (left) takes an hour's time by one man.

STRONG-SCOTT Unit Pulverizers are backed and guaranteed by 50 years of manufacturing experience—24 in the combustion engineering field.

Hundreds of installations have been made in over 200 American cities and several foreign countries. Visit one of these and learn about STRONG-SCOTT design and dependability first hand.

WRITE FOR BULLETIN

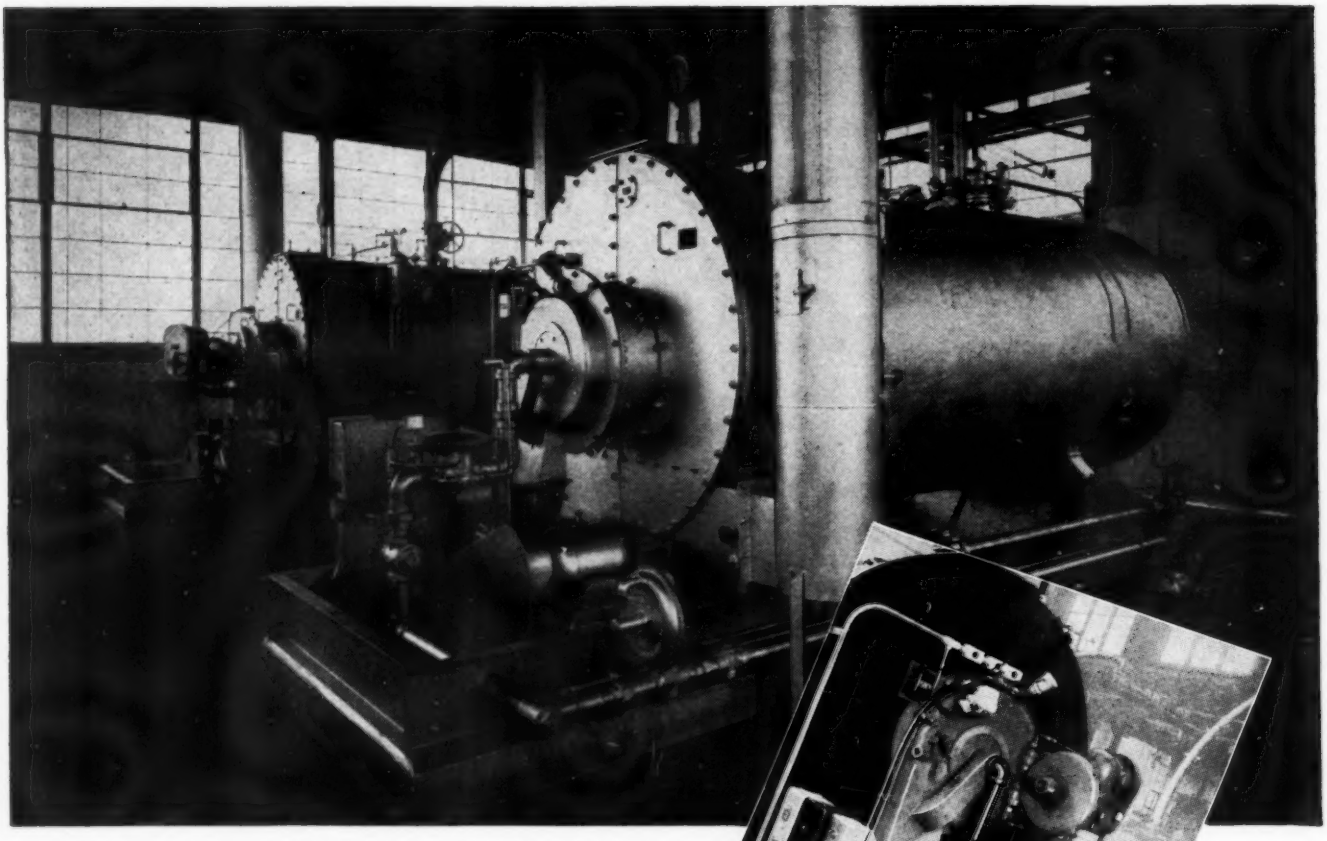
Send for descriptive Bulletin for complete information.
Names of customers in your vicinity furnished on request.

The STRONG-SCOTT Mfg. Co.
455 TAFT STREET N. E. • MINNEAPOLIS 13, MINN., U. S. A.

STRONG SCOTT
UNIT PULVERIZER

BURN GAS — BURN OIL — BURN EITHER

in Steam Generators Expressly Adapted to the Fuel in your Area

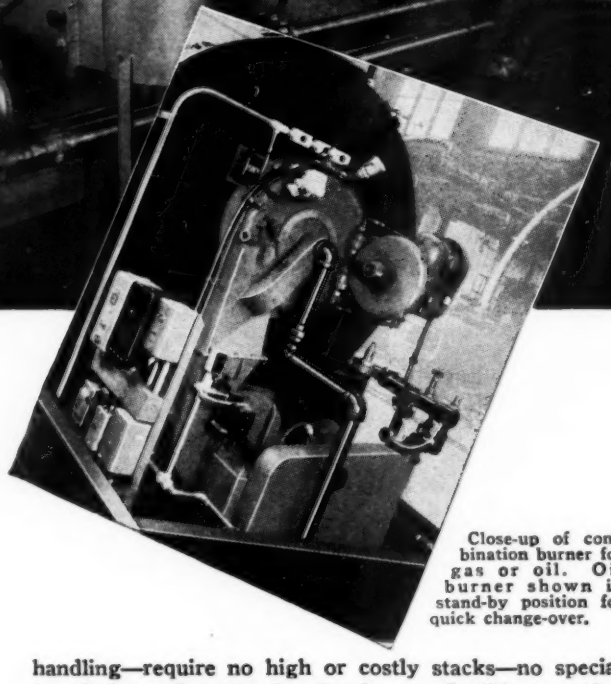


Installation shows two models of 200 HP. Cleaver-Brooks Steam Generators. Foreground model — gas-fired; model shown in rear equipped with a combination burner to burn either gas or oil.

Get Guaranteed 80% Efficiency with either Fuel with a Cleaver-Brooks Steam Generator

INSTALL a steam generator equipped to burn the available fuel in your area—either oil or gas. Cleaver-Brooks offers all three: (1) Oil-fired models, (2) gas-fired models, and (3) models equipped with a combination burner which permits alternate use of gas or oil, providing for a quick change-over from one fuel to the other. Equally important—you get Cleaver-Brooks' guarantee of at least 80% efficiency from full load down to 30% of rating—with either gas or oil as fuel.

And that's not all—more advantages are gained using a Cleaver-Brooks "packaged" steam generator. They give you clean, smokeless operation—eliminate fuel-ash handling—require no high or costly stacks—no special foundations—fit under low headroom—flexible operation to meet fluctuating loads. Fully meet all codes.



Close-up of combination burner for gas or oil. Oil burner shown in stand-by position for quick change-over.

Investigate Cleaver-Brooks Steam Generators—there's a size to fit your needs—15 to 200 p.s.i., 15 to 500 HP.

CLEAVER-BROOKS COMPANY

332 E. KEEFE AVE., MILWAUKEE 12, WISCONSIN

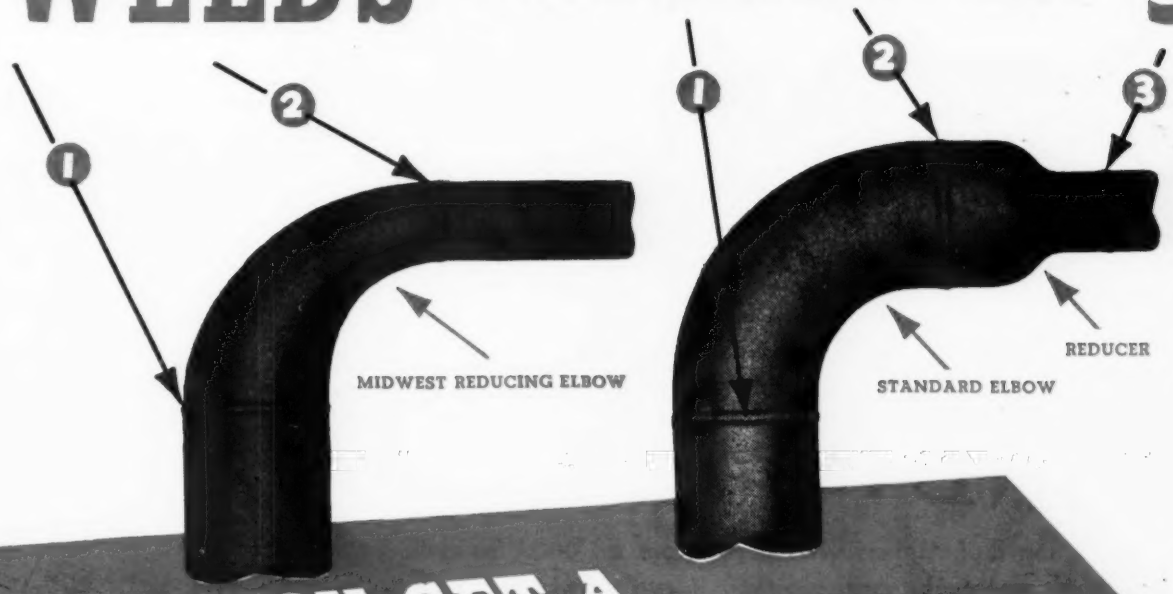
WRITE on your business letterhead for free Steam Cost-Calculator — a ready-reference slide rule showing comparative steam cost when using oil, gas or coal as fuel.

Cleaver-Brooks

"Packaged" STEAM GENERATORS

HAVE SERVED INDUSTRY FOR MORE THAN FIFTEEN YEARS

2 WELDS INSTEAD OF 3



AND YOU GET A BETTER PIPING JOB

MIDWEST

REDUCING WELDING ELBOW

- SAVES WELDING
- SAVES MONEY
- SAVES TIME
- REDUCES TURBULENCE
- IMPROVES APPEARANCE

One weld is eliminated when the Midwest Reducing Elbow is used to change both direction and pipe size in a welded pipe line . . . you make only two welds instead of three. This exclusive Midwest Fitting takes the place of both a standard elbow and a reducer, as shown above. This saves time and money, produces a smoother, cleaner, better appearing job. In addition, the gradual reduction, smooth curve and absence of abrupt neck reduce turbulence. Insulation is also easier.

All the advantages of Midwest Standard Elbows are to be found in Midwest Reducing Elbows . . . unusual dimensional accuracy, beneficial effect of working metal in compression, stress relieving, etc. Center-to-end dimensions are the same as for standard elbows with which they are interchangeable.

This reducing elbow is one of many Midwest Welding Fittings designed to reduce the cost and improve the quality of welded piping. Write for Bulletin WF-41 for complete information.

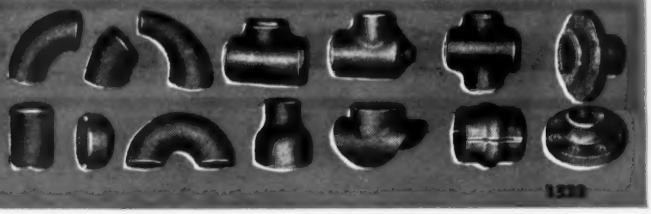
MIDWEST

PIPING & SUPPLY COMPANY, Inc.

Main Office: 1450 South Second St., St. Louis 4, Mo.

Sales Offices: New York 7—30 Church St. • Chicago 3—79 West Monroe St. • Los Angeles 33—520 Anderson St. • Houston 2—229 Shell Bldg. • Tulsa 3—533 Mayo Bldg. • South Boston 27—426 First St. • Distributors in Many Cities.

MIDWEST WELDING FITTINGS IMPROVE DESIGN AND REDUCE PIPING COSTS



ONE *recognized standard*

THE COTTRELL PROCESS OF ELECTRICAL PRECIPITATION

FOR GAS CLEANING, smoke abatement and removal of dust, fume, tar and other suspended matter from gas, there has been one universally accepted process for more than thirty years. In answer to your special problem, a Cottrell installation incorporating this rich experience in research, development and worldwide operation means the complete fulfillment of your requirements.

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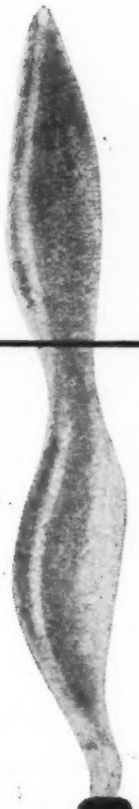
Dearborn Treatment and Service Solved the Boiler Water Problem

in this Power Plant



● Five boilers of 5,000 hp total rating produce the steam for power generation and for heating dry kilns.

The make-up water, taken mostly from a near-by log pond, contains a high percentage of solids, including organic matter.

Dearborn internal treating method and test procedure was recently installed. Since then, among other advantages the time required to clean each boiler has been greatly reduced.

Dearborn Engineer studied all phases of the water problem . . . solved it . . . and now in his frequent service calls assists the plant engineer to maintain good boiler efficiency resulting from correct water treatment.

Dearborn
TRADE MARK REGISTERED

THE *Leader* FOR 60 YEARS

ENGINEERING SERVICE AND WATER TREATMENT

DEARBORN CHEMICAL COMPANY
Dept. D, 310 S. Michigan Ave., Chicago 4, Ill.

SPECIALISTS GET BETTER RESULTS

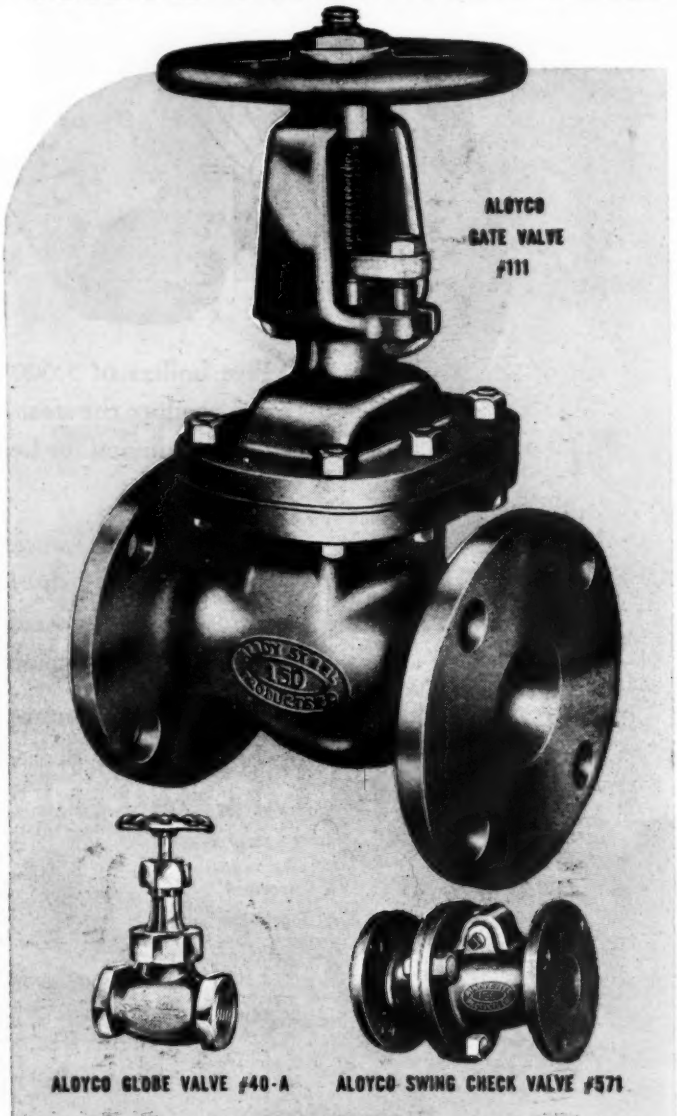
...in medicine and in VALVE MANUFACTURE

● The superiority of the specialist, in his branch of medicine, over the general practitioner, is widely recognized today. The same thing is true in the manufacture of corrosion-resistant valves.

This Company makes nothing but valves. And we confine our activities entirely to valves of stainless steels and other corrosion-resistant alloys. We are the only manufacturer who specializes to that extent.

A high degree of science is involved in the manufacture of successful corrosion-resistant valves. The chemistry of corrosion, the metallurgy of stainless steels and mechanical engineering in the correct design of such valves, are all included in this science. Such skills are not acquired in a day. We have been at it a long time. That is why leaders in the process industries come to Aloyco for advice on corrosion-resistant valves. You, too, will find it profitable to consult our metallurgical service on your requirements.

Aloyco's new catalog #47 tells the story of this specialization and gives full details of alloys, types and applications. Send for your copy on your letterhead.



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VALVES AND FITTINGS

GATE, GLOBE, Y, CHECK, TANK, SAMPLING AND V-PORT VALVES
SCREWED AND FLANGED FITTINGS

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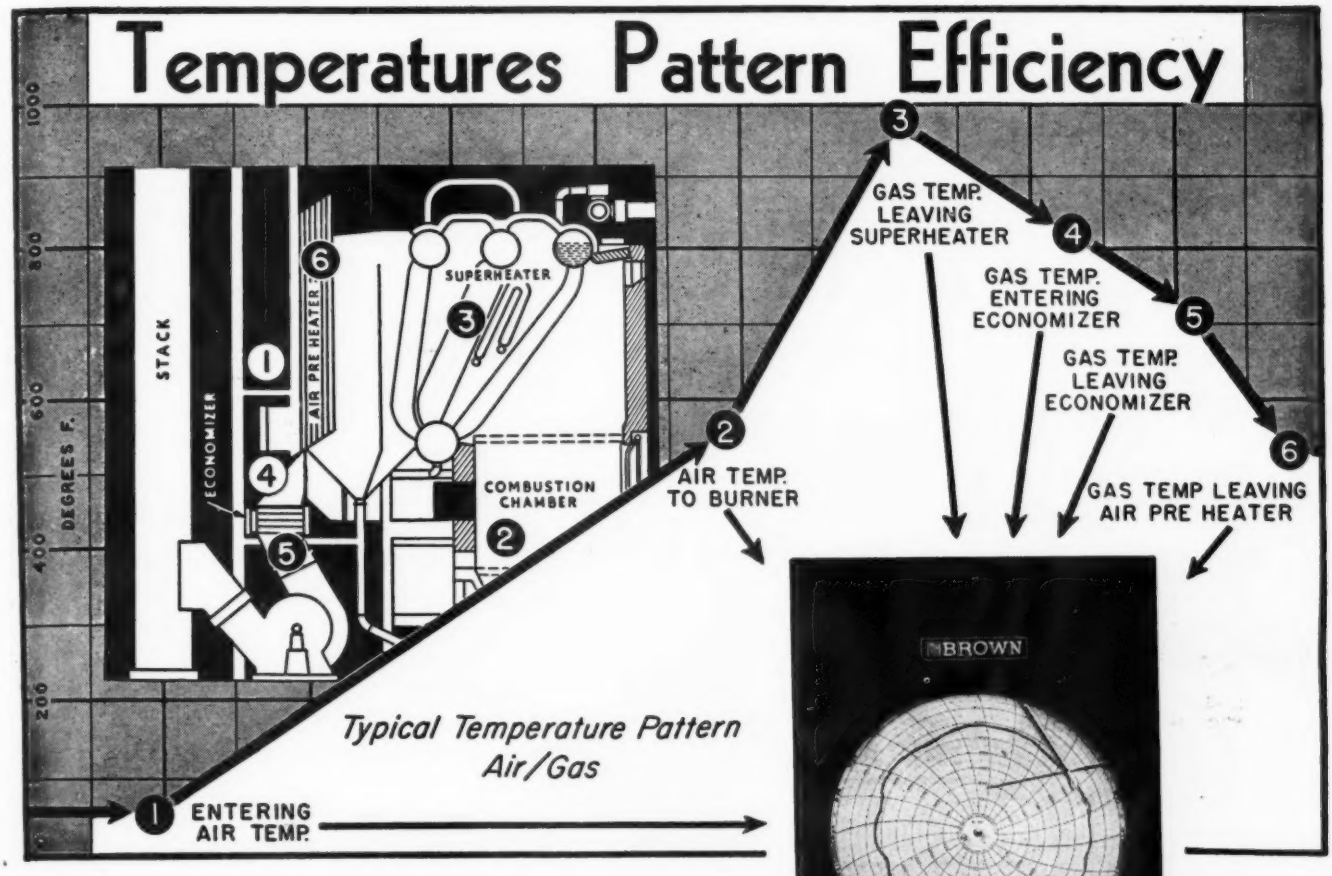
1403 WEST ELIZABETH AVE. • • LINDEN, N. J.



Brown Thermometers increase efficiency . . . at every step

The above pattern shows air/gas temperatures for a typical boiler. Maintaining this temperature pattern at each step from the air intake to the stack is important for high boiler efficiency.

By having a continuous record of these important temperatures, your power engineer can maintain high efficiency. Without them, he is operating in the dark . . . inefficiencies show themselves only in unexplainably high power costs.

Brown Recording Thermometers for these points are an economical investment for large or small power plants. The advanced design of these instruments provides a degree of accuracy and utility never before offered in a thermometer. The special heat treating and stress relieving of the spiral actuating elements alone is an achievement in manufacturing that means better performance to you. Brown Thermometers last for years and years . . . but pay for themselves quickly in lower power costs.

Your local Brown Engineer will be glad to discuss these steps to increased power plant efficiency with you. Write for further information. Send for your copy of Catalog 6708 describing Brown Recording Thermometers.

Write for Catalog 6708

The Brown Instrument Company, 4490 Wayne Avenue, Philadelphia 44, Pa.

DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR CO.

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BROWN *Advanced Instrumentation* FOR BETTER PROCESSING

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Rockbestos A.V.C. is specified by steel mills, refineries, power companies and manufacturing plants because it won't bake brittle, crack or flow when exposed to operating temperatures up to 230°F. Moreover, this cable is not injured by corrosive fumes, grease or oil because it's insulated with *impregnated asbestos* — which won't rot or bloom. And time-tested installations prove conclusively that Rockbestos A.V.C. withstands severe heating and cooling cycles in conduit where other types require frequent replacement.

Couple these maintenance savings with Rockbestos' greater current carrying capacity and it's easy to see why you'll decide on the cable which helps you avoid wasteful maintenance — and steers those dollars toward the bank!

Several types for power, lighting and control circuits, switchboards and equipment, in 600 to 5,000 volt ratings. Write our nearest district office for information or recommendations.

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Why It's Trouble-Free!

A tough, non-aging impregnated asbestos braid resistant to heat, flame, moisture, grease, oil and corrosive fumes.

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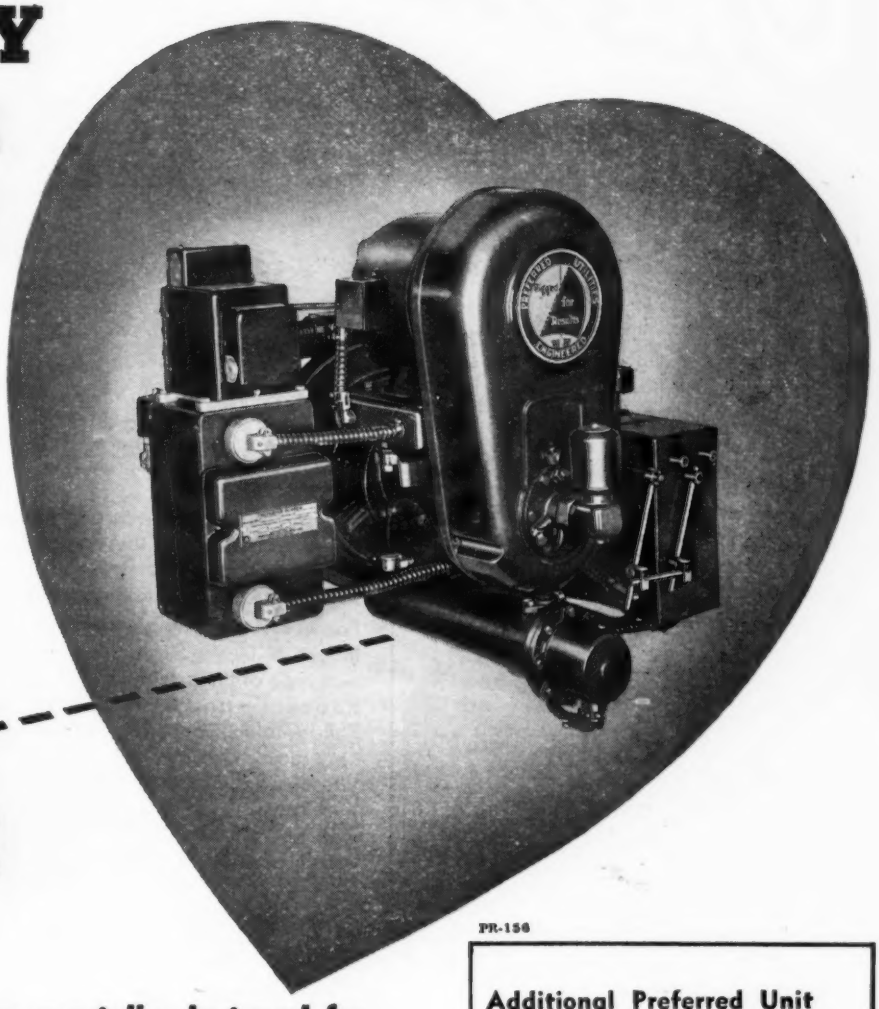
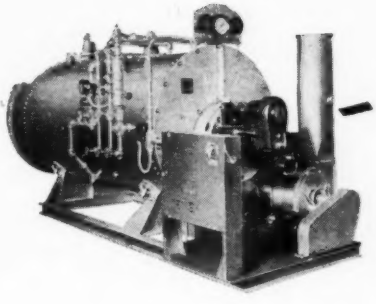
- An inner wall of heat and flame resistant impregnated asbestos which acts as a baffle between the varnished cambric and hot conductors.
- The conductor is perfectly and permanently centered in non-flowing heat resistant insulation that provides greater current carrying capacity.

One of 125 different constructions designed by Rockbestos for severe operating conditions in ratings up to 5000 volts.

ROCKBESTOS A.V.C. ROCKBESTOS *The Wire with Permanent Insulation*

This Steady Heart Means a HEALTHY POWER PLANT





PR-156

The only rotary oil burner specially designed for firing in the elongated furnace of a "packaged" boiler.

The Preferred Horizontal Rotary Oil Burner is the "heart" of the Preferred Unit Steam Generator . . . a heart that steadily supplies the correct amount of oil for economical combustion.

Constant volume of fuel oil—regardless of variations in temperature, pressure, or viscosity of the oil—is assured by the patented "Voluvalve" fuel regulation and the dual pump reservoir.

Ignition is reliable and automatic, due to the low-voltage hot-wire igniter assembly. Thorough atomization of heavy oils is provided by the higher cup speeds, made possible by the high-speed belt drive.

Maximum combustion efficiency is achieved throughout the entire throttle range by an air control device coordinated with oil feed control. Automatic high-low operation is standard on all Preferred Unit Steam Generators of 100 H.P. and over, and is also available on smaller units.

Preferred's Bulletin 175 tells the complete story of the Preferred Horizontal Rotary Oil Burner . . . and Bulletin 1000-E describes in detail other engineering features of the Preferred Unit Steam Generator.

Additional Preferred Unit Steam Generator Features

1. Induced (pull-through) Draft—eliminates necessity of building expensive stacks. Only a simple vent to the outside air required. No escape of products of combustion into the boiler room.

2. Fully Automatic Operation — even with Bunker C or No. 6 oil.

3. Four-pass Down-Draft Gas Travel—results in maximum heat absorption.

4. 80% Minimum Thermal Efficiency—proved and guaranteed.

5. Full Range of Sizes—from 20-500 H.P., and pressures of 15 to 200 lbs. Two-pass units in 20 and 30 H.P., 15 lbs. pressure.

Four-pass units also available in all sizes for 250 p.s.i.g. design on special order. Write for complete details of these special units.

P-2-48

WRITE FOR BOTH BULLETINS TODAY.

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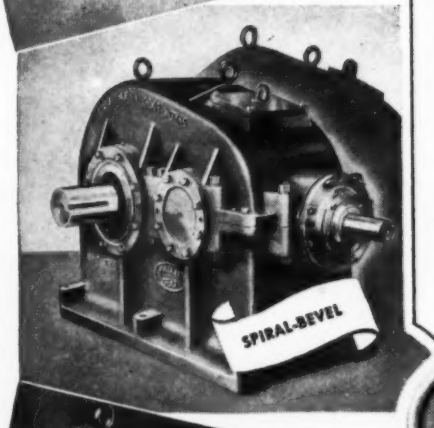
In fact, Phillie Gear was one of the true Pioneers in the design and manufacture of *Speed Reducers, for Industrial Purposes.*

For every conceivable type of Industrial Drive, there is a correct type of Philadelphia Speed Reducer—and by choosing Philadelphia Reducers, you not only secure *Quality Products,* but you place the responsibility for their construction and operation with one *manufacturer* (a point worthy of serious consideration).



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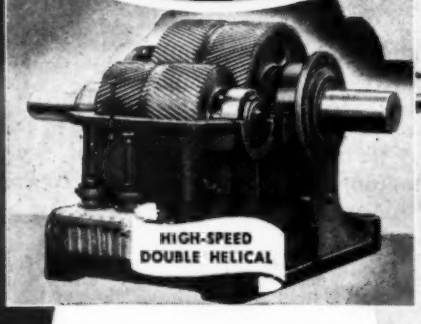

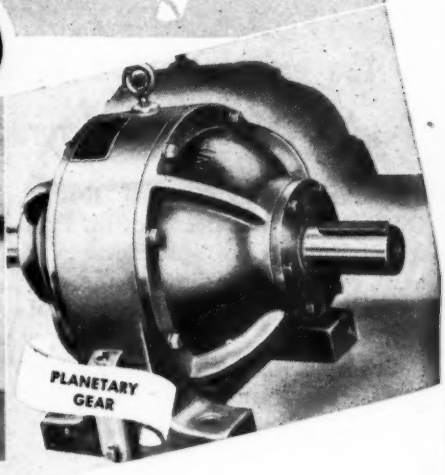

PHILADELPHIA SPEED REDUCERS ARE THE RESULTS OF 55 YEARS CONTINUOUS EXPERIENCE

Philadelphia GEAR WORKS INCORPORATED

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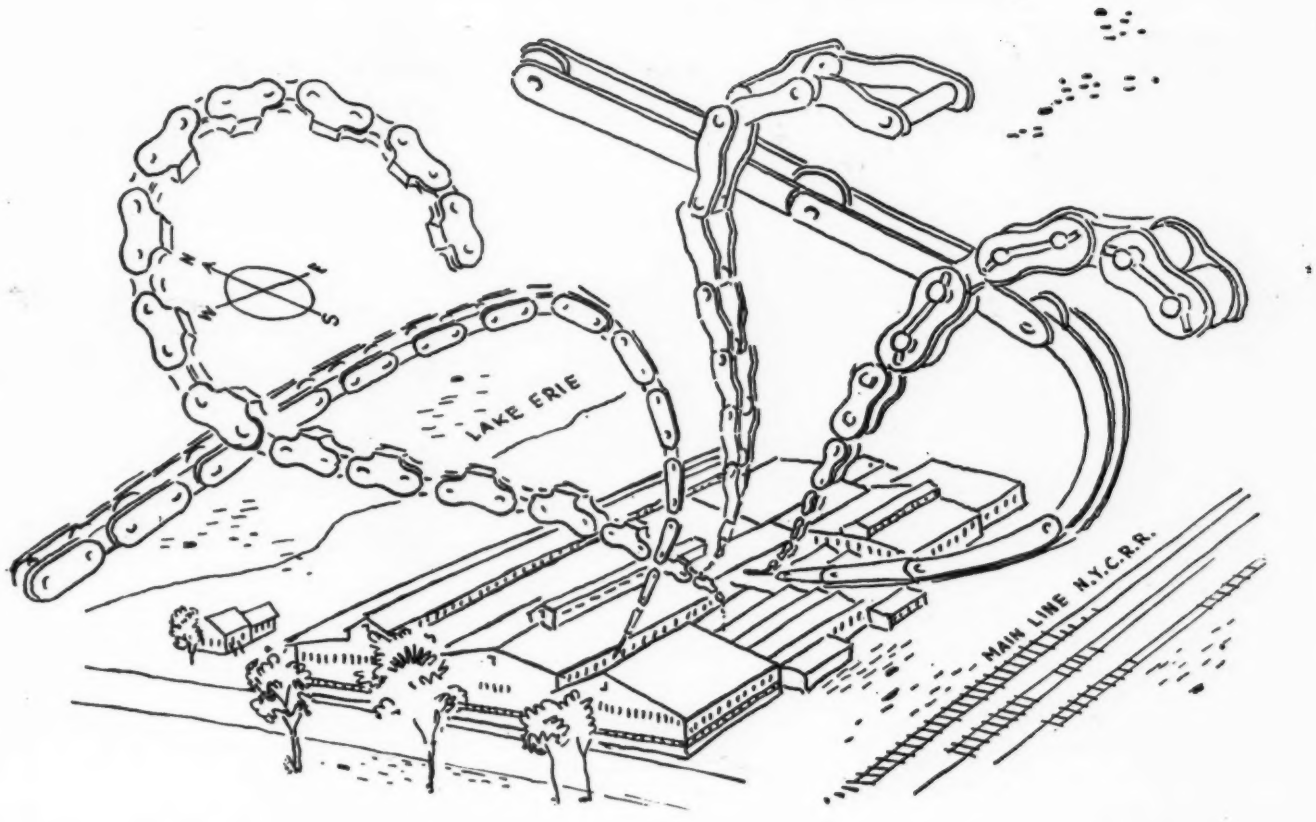

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Union Chains for Every Application

Drive and Conveying Chains and Sprockets
- Bridge Chain
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- HB (hardened bearing) type chain
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Finished Steel Roller Chains and Sprockets
- All manufacturer's standard, size ⅜ in. to 2½ in. pitch
- Single and Multiple Strands
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- All sizes ⅜ in. to 1½ in. pitch

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Flexible Couplings
- Roller chain type
- Silent chain type

Principally that it was built for the express purpose of manufacturing all types of Steel Sprocket Chains, Accessory Attachments, and . . . nothing else.

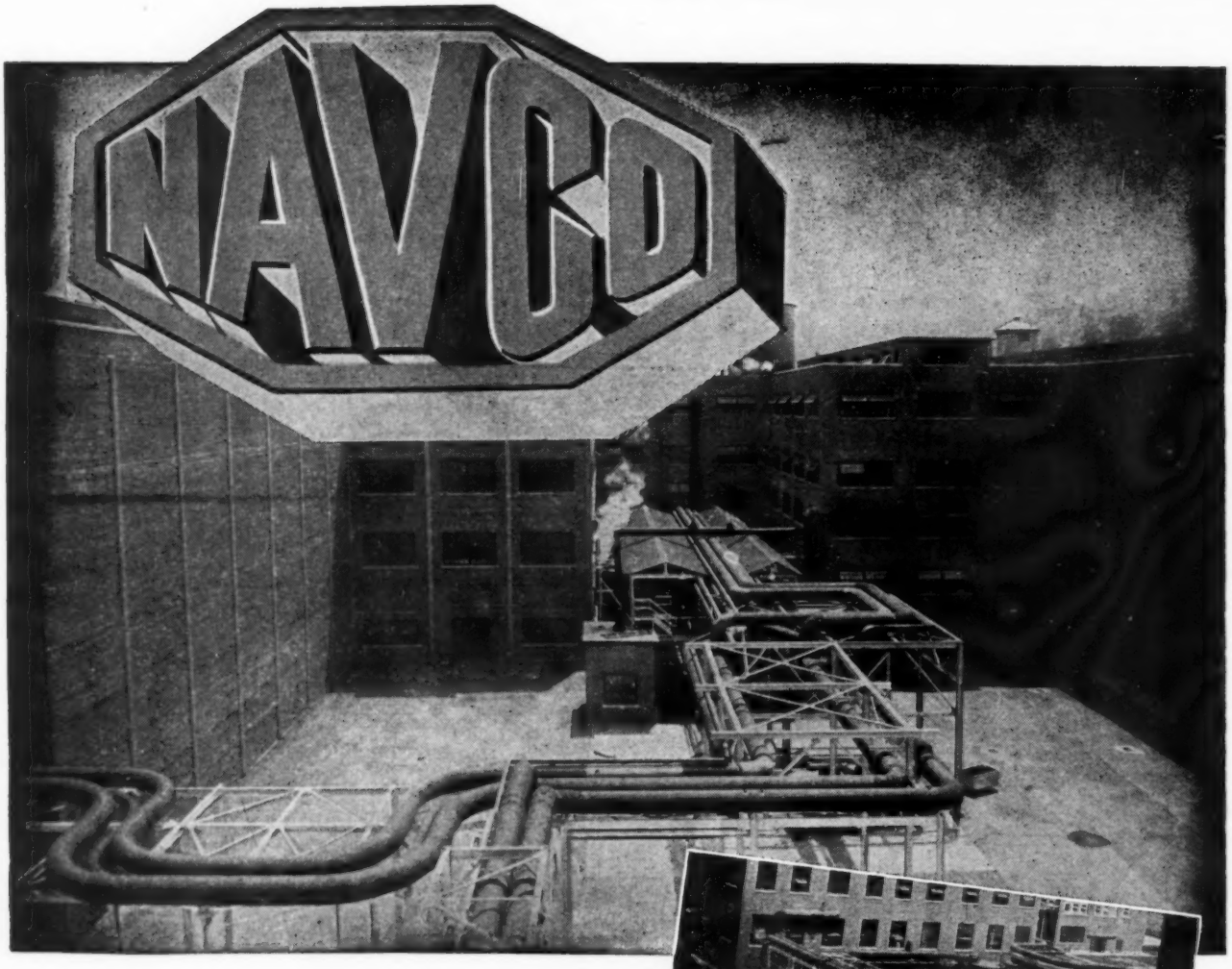
This distinction, however unusual in the chain industry, is of no consequence unless it means something to you as a user of chain. We believe that it does because it provides the twin benefits of economy and high quality resulting from specialization. Union's plant is a modern, one floor, straight line layout, which receives raw materials at one end and ships finished chain from the other in quantities which are constantly increasing.

If some of Union Chain's production is not already "tagged" for you, plan with us now for the day when it will be.

The Union Chain and Manufacturing Company

TRANSMIT POWER UNION CHAINS CONVEY MATERIALS

Sandusky, Ohio, U.S.A.

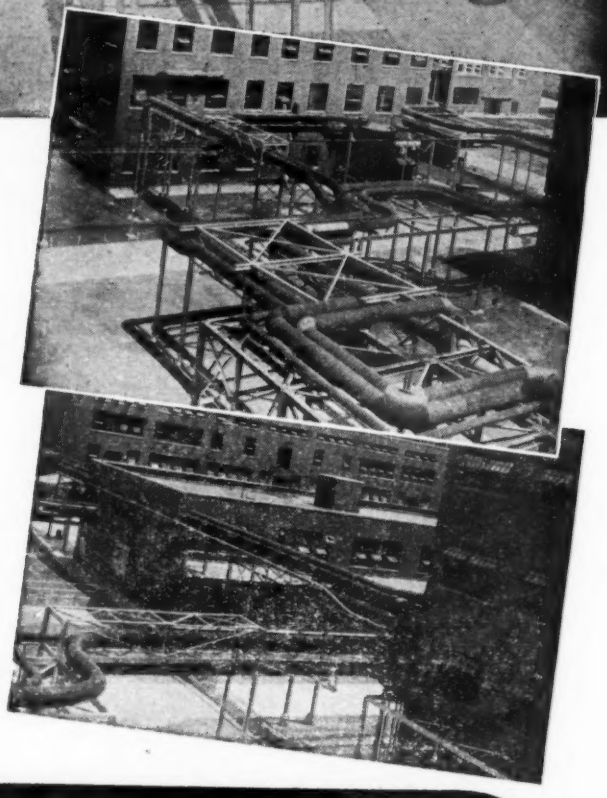


SKILLED ENGINEERING

The difficulties encountered in the fabrication and erection of Central Station and Industrial Piping are many and varied.

The high degree of skill acquired by Navco Engineers from long experience in solving unusual Piping problems is your assurance of economy and safety of operation.

Consult Navco for your next Piping Job.



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NATIONAL VALVE & MANUFACTURING COMPANY • PITTSBURGH, PA.

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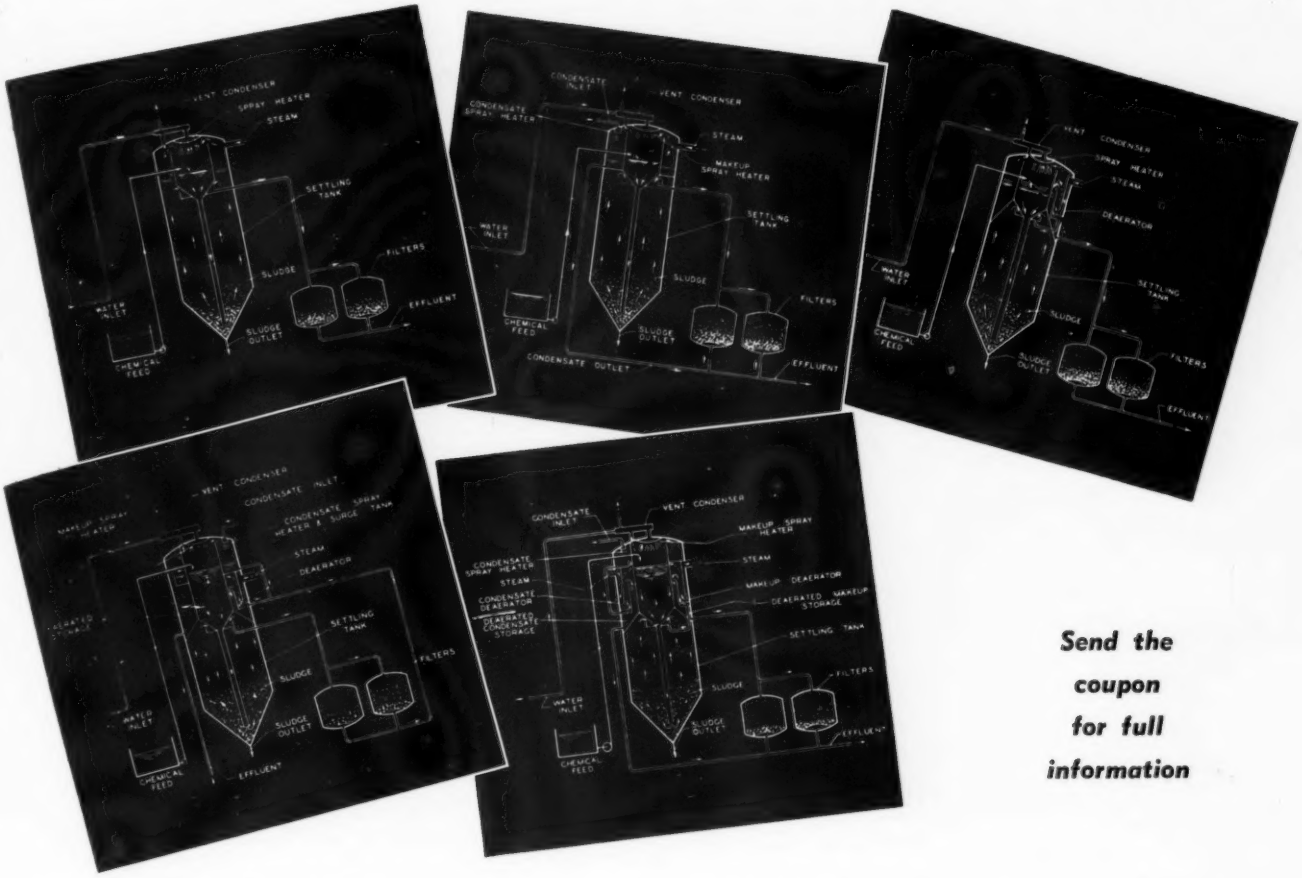
Not one, but...FIVE types of

LIQUON HOT PROCESS WATER SOFTENERS



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LIQUON has developed FIVE types of Hot Lime-Soda Water Softeners to be sure of having exactly the right type for every requirement . . . a typical example of LIQUON COMPLETENESS in Water Treatment Processes and Equipment.

No matter what your plant conditions, LIQUON can therefore provide the most effective and economical Hot Process installation.

Each type of LIQUON Hot Process Softener operates with a deep bed of suspended precipitated sludge through which the treated water percolates.

This LIQUON sludge-blanket principle produces a clearer water and uses less chemical than older types of settling tank softeners. It also reduces silica more efficiently.

The COMPLETENESS of LIQUON Service extends to EVERY requirement for liquid conditioning. Whatever your water softening or clarifying needs, consult LIQUON for authoritative advice and modern equipment, based on more than a quarter century of experience. Your inquiries are invited, without obligating you in any way.

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R/M flexible metallic packing

R/M No. 920

R/M's flexible metallic packing is a new and valuable addition to the R/M line, recommended for use on steam and air rods, centrifugal pump shafts, valve stems and other applications where the temperature does not exceed 450°F., and surface speed is less than 600′ per minute.

Like a fabric packing, this packing is sensitive to gland adjustment, but it has the added advantage of non-frictional wearing surface. It is constructed of non-frictional metallic foil and asbestos yarns, combined with temperature-resistant lubricants and flake graphite. The outer layer is an open-mesh, braided cotton jacket.

This packing is typical of the engineering that goes into R/M products. For special jobs where you need packing by prescription, or for the routine work where you demand the utmost in dependability, see the authorized R/M distributor near you.

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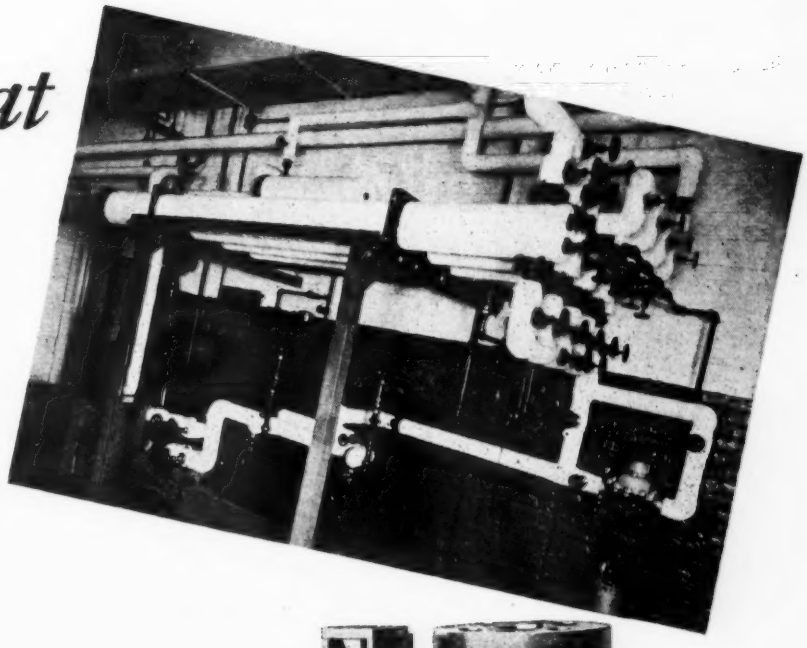
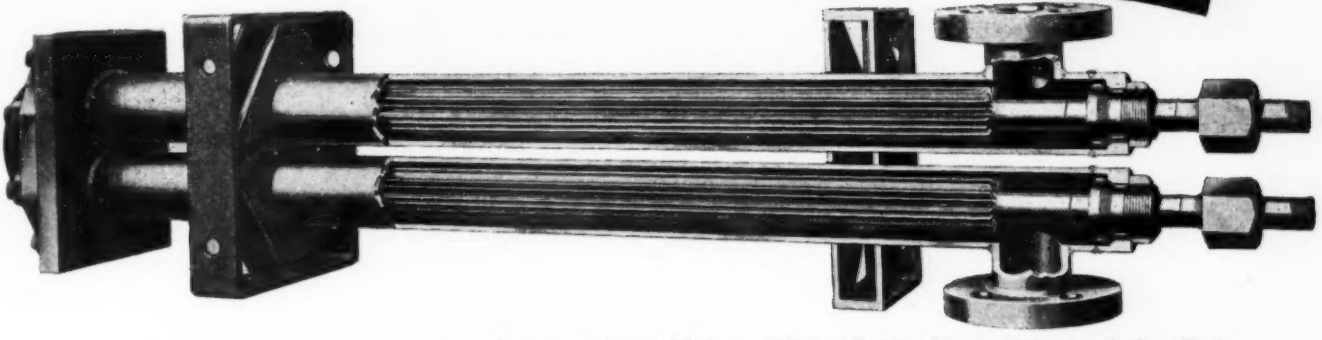
IT'S "PACKED WITH SATISFACTION" WHEN YOU USE R/M

R/M

Isn't this what you want in a **FUEL OIL HEATER?**





SIMPLE — Just a pipe within a pipe—that's the principle of the Twin G-Fin Section. The G-Fin inner pipe, through which the steam passes, has longitudinal fins to provide greater surface for transfer of heat to the oil flowing through the outer pipe.

COMPACT — The longitudinal G-Fins provide at least six times as much heat transfer surface as bare tubes . . . the result: the Twin G-Fin unit has fewer tubes than any other type of heater.

LEAK PROOF — Leakage between steam and oil cannot occur because there are no internal joints.

READILY INSTALLED — The Twin G-Fin Section is easily handled, and can be placed close against a wall, ceiling or floor . . . wherever most convenient. Movable supports further assist convenient installation.

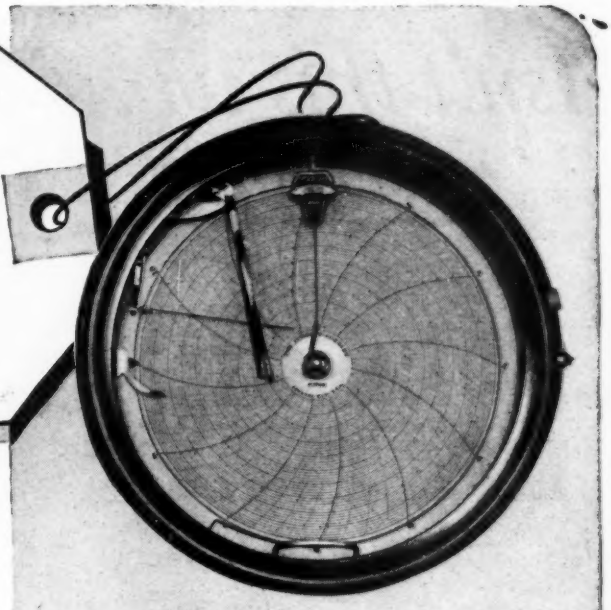
FLEXIBLE CAPACITY — These units are standard and interchangeable. They may be arranged in series or parallel; and at partial loads, sections may be cut in and out to maintain constant oil temperature.

EASY TO CLEAN — The G-Fin heating elements or pipes may be completely removed from the shells for cleaning, without disturbing the oil connections. No special tools are required.

THE GRISCOM-RUSSELL CO., 285 MADISON AVENUE, NEW YORK 17, N. Y. GR-192

GRISCOM-RUSSELL
TWIN G-FIN SECTION
The Universal Heat Exchanger

Automatic Cure for Plugging of Travelling Intake Screens



Simple FOXBORO Control System operates screen whenever suction level drops . . .

HERE'S AN EASY, inexpensive way to make sure that your condenser well won't go dry if excessive refuse causes sudden plugging of the travelling screen.

Foxboro Travelling Screen Control supplements periodic screen-timing with a "judgment" that's almost human. By continuous measurement of water level on each side of the screen, this sensitive control system independently starts the cleaning action whenever a predetermined safe differential is exceeded. When correct levels are again restored, it automatically shuts down screen and spray motors. In case of unusually severe fouling of the screen, the controller can also operate a warning signal.

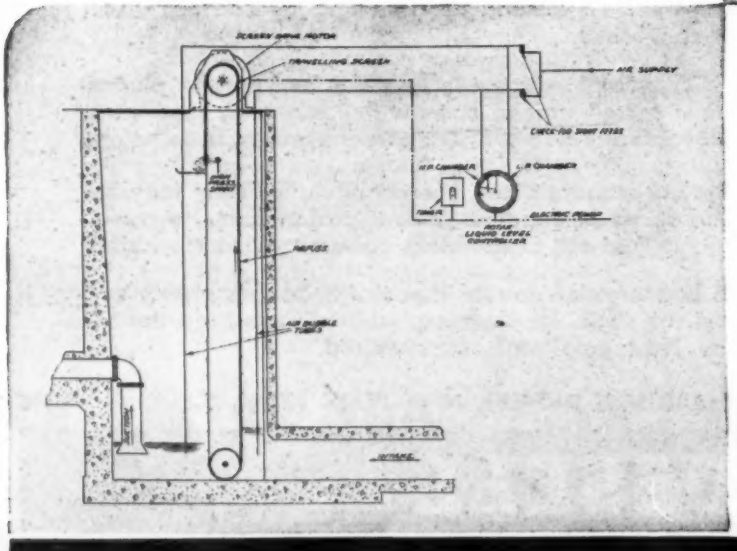
Write for complete information on Foxboro Travelling Screen Control and Bulletin 184-4 containing details of Foxboro Rotax Controllers. **The Foxboro Company, 68 Neponset Ave., Foxboro, Mass., U. S. A.**

ROTAX

Liquid Level Controller

The "heart" of Foxboro Travelling Screen Control. An extremely simple, positive-operating controller that translates level differential into operation of motors. In addition, it can operate a warning horn or light in case of unusually severe plugging.

Exclusive Rotax features include: positive electrical contact; special lock-up circuit which eliminates chattering of control relays; constant brush pressures; self-cleaning platinum contact surfaces; easy setting of control point; and freedom from maintenance.



SCHEMATIC DIAGRAM, left, shows simplicity of Foxboro Travelling Screen Control System. Water level differential through the screen is continuously measured by bubble tubes. The Foxboro Rotax (electric) Controller starts and stops the screen and spray motors, as required to maintain safe differential.

FOXBORO
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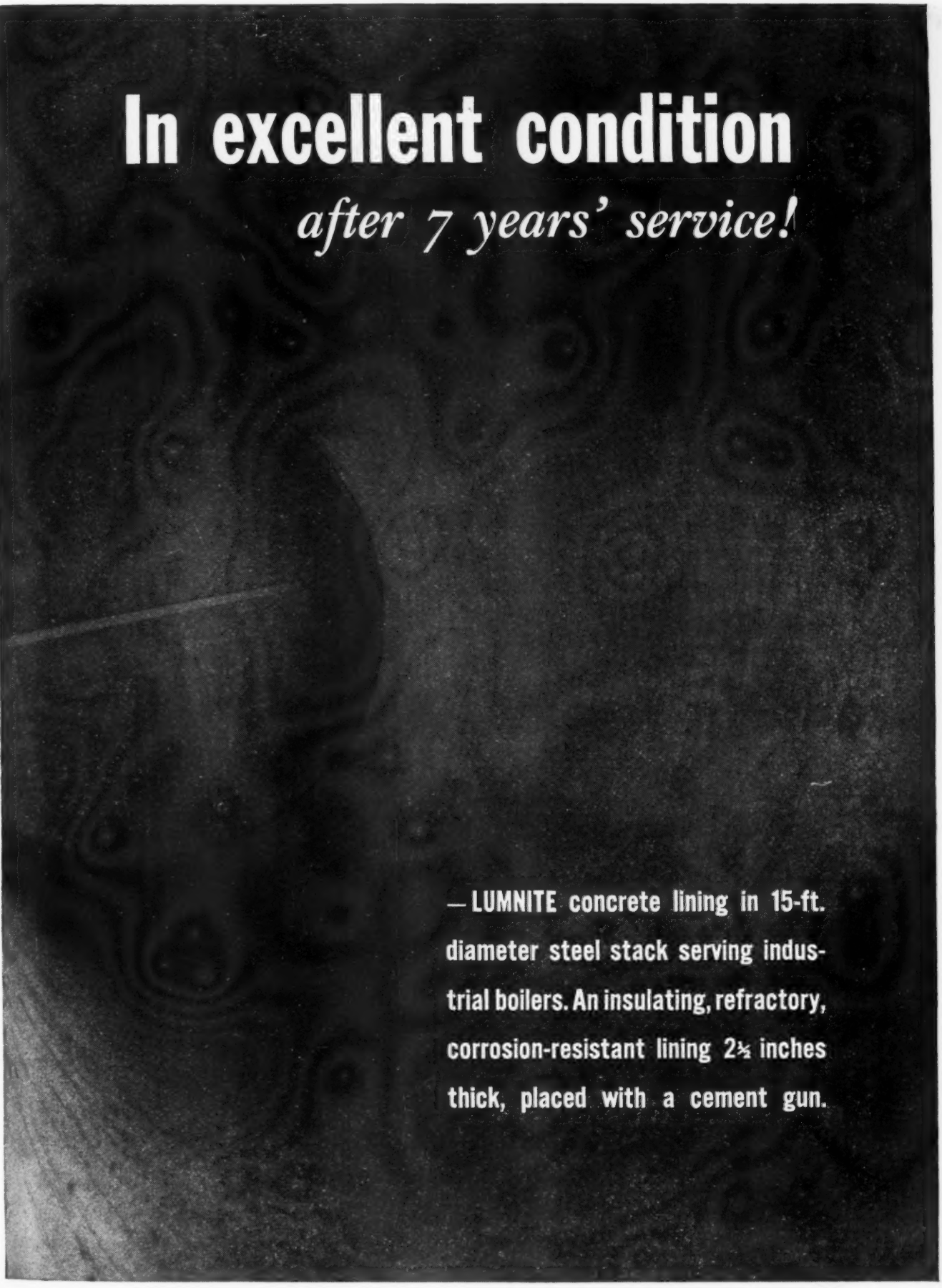
RECORDING · CONTROLLING · INDICATING
INSTRUMENTS

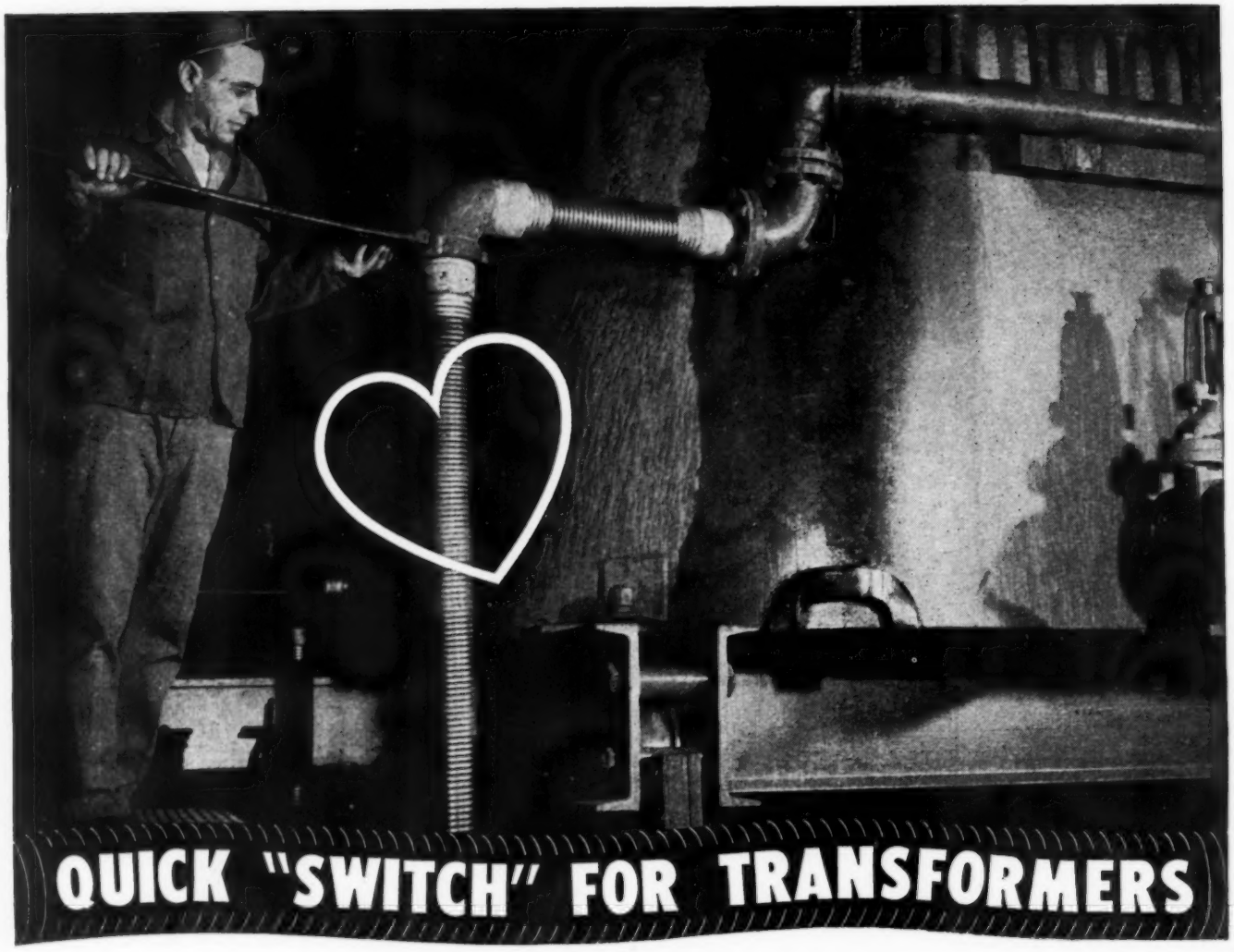
In excellent condition

after 7 years' service!



— LUMNITE concrete lining in 15-ft. diameter steel stack serving industrial boilers. An insulating, refractory, corrosion-resistant lining 2½ inches thick, placed with a cement gun.

For booklet, "CONCRETE LININGS IN STEEL STACKS," write LUMNITE DIVISION, Universal Atlas Cement Company (United States Steel Corporation Subsidiary), 135 East 42nd Street, New York 17, New York.



QUICK "SWITCH" FOR TRANSFORMERS

Penflex metal hose cuts replacement time ⅓
... reduces costs ... speeds power resumption

Replacing faulty 220,000-volt transformers in a mammoth hydro-electric power station became a lengthy, troublesome task for one Eastern utilities company. When one of these 12 giants needs repairs, a spare has to be put in its place and quickly connected to cooling water pipes before resumption of service.

But since no two transformers are precisely alike, it was difficult to line up pipe flanges for bolting. Often special "wedges" had to be machined and inserted to obtain tight sealing . . . pipes had to be heated and bent . . . power output was delayed.

Troubles soon disappeared when Penflex engineers recommended 4" bronze interlocked flexible metal hose assemblies. Now, transformers are switched in almost ⅓ less time. Connections are quickly made because flexibility of hose allows for misalignment. Special machining and bending operations are eliminated . . . power is speedily resumed . . . man-hours reduced.

Penflex "Flexineering" (the science of engineering each type of flexible tubing to the problem) can help you iron out production wrinkles easily, economically. It will pay to know more about Penflex tubing layout service, streamlined for quick solution to your problems on flexible transmission of liquids, air, gases, or light solids. For complete service on flexible hose, tubing and couplings from ⅛" I. D. to 30" I. D., write today to . . .

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Penflex... HEART OF INDUSTRY'S LIFE LINES

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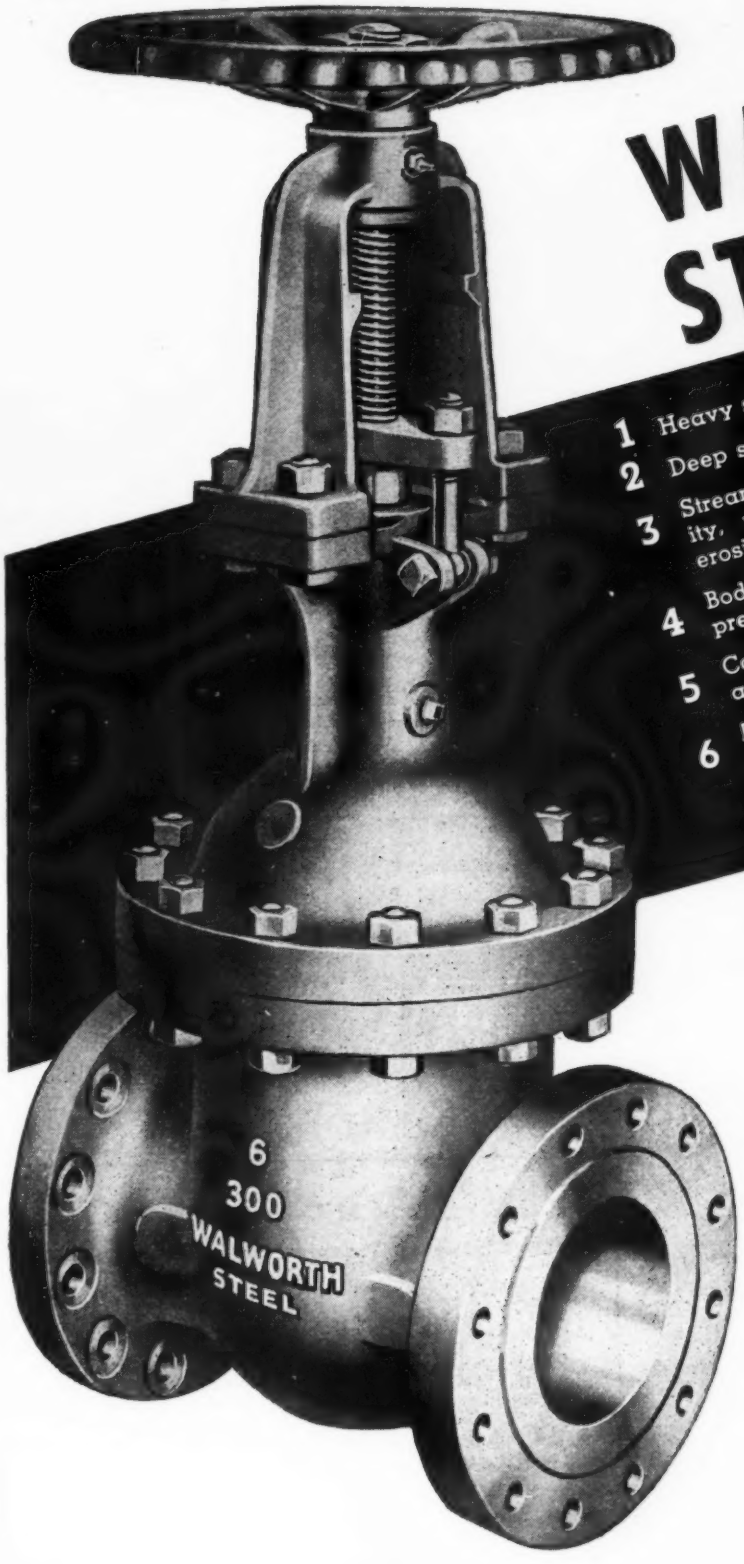
You get all these BIG features in WALWORTH STEEL VALVES



1 Heavy steel walls for extra strength and protection.

2 Deep stuffing boxes to eliminate costly leaks.

3 Streamlined ports to make possible a high velocity, non-turbulent flow, and reduces possible erosion.

4 Bodies and bonnets engineered to withstand pressure and minimize distortion.

5 Cast body guide rib faces, machined to insure accurate disc centering.

6 Exact design, metallurgy and construction of yoke nuts, bonnet bushings, gland followers, handwheels and other vital parts to assure better service for a longer period of time.

Is there any wonder that out in the field, where approval is based on performance under actual operating conditions, industry has put its O.K. on Walworth Steel Valves?

Tough . . . wear resistant . . . dependable, these valves are produced in gate and globe types, in sizes to cover practically every service requirement. They are excellent examples of Walworth leadership . . . leadership that has made the Walworth valves famous throughout the world.

Walworth Catalog 42 gives complete information regarding Steel Valves as well as the full line of Walworth valves and fittings in bronze and iron. Your copy may be obtained upon request. Whenever you need valves — whether steel, bronze or iron — remember Walworth for dependability, economy, and long service life.

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valves and fittings
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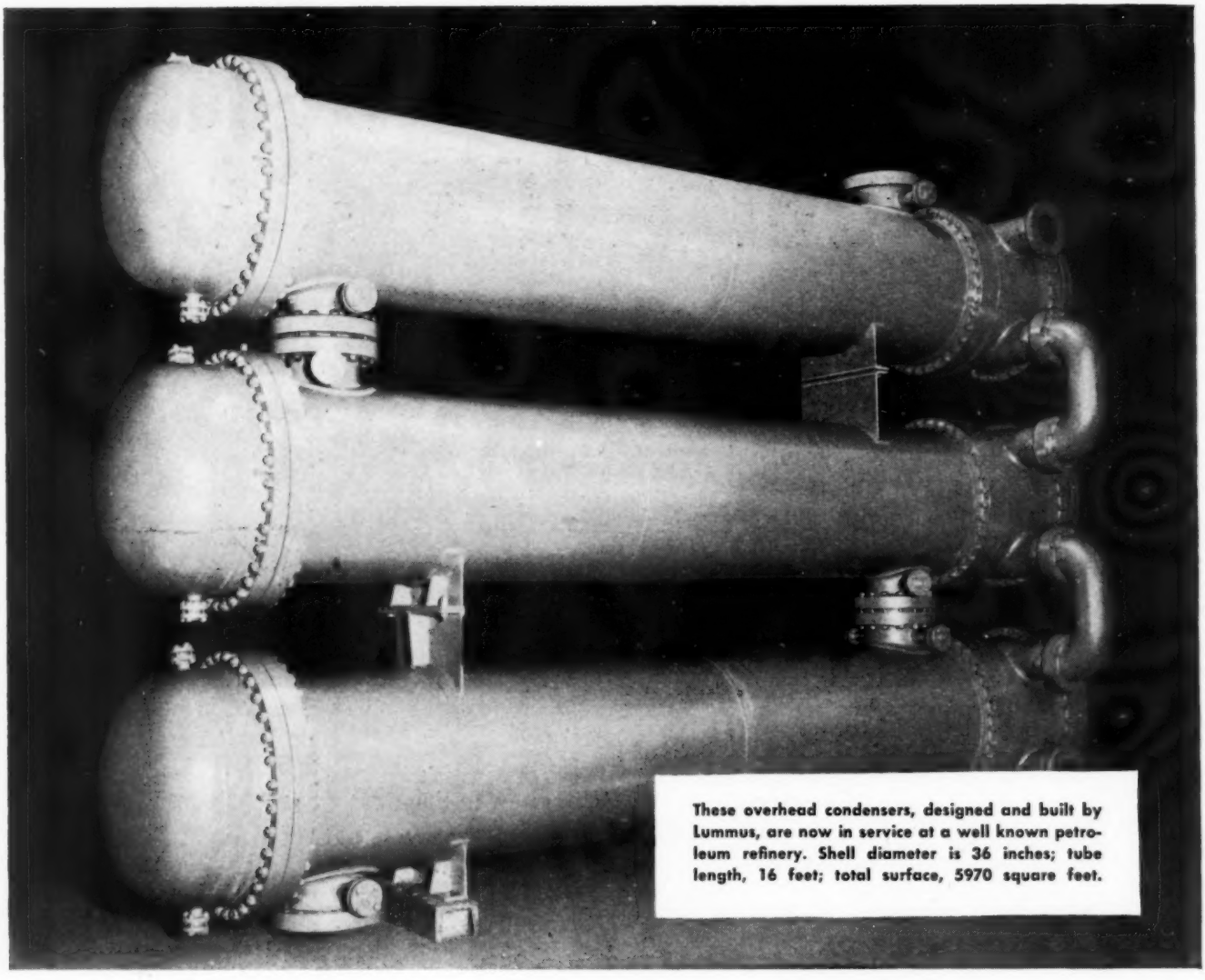

These overhead condensers, designed and built by Lummus, are now in service at a well known petroleum refinery. Shell diameter is 36 inches; tube length, 16 feet; total surface, 5970 square feet.

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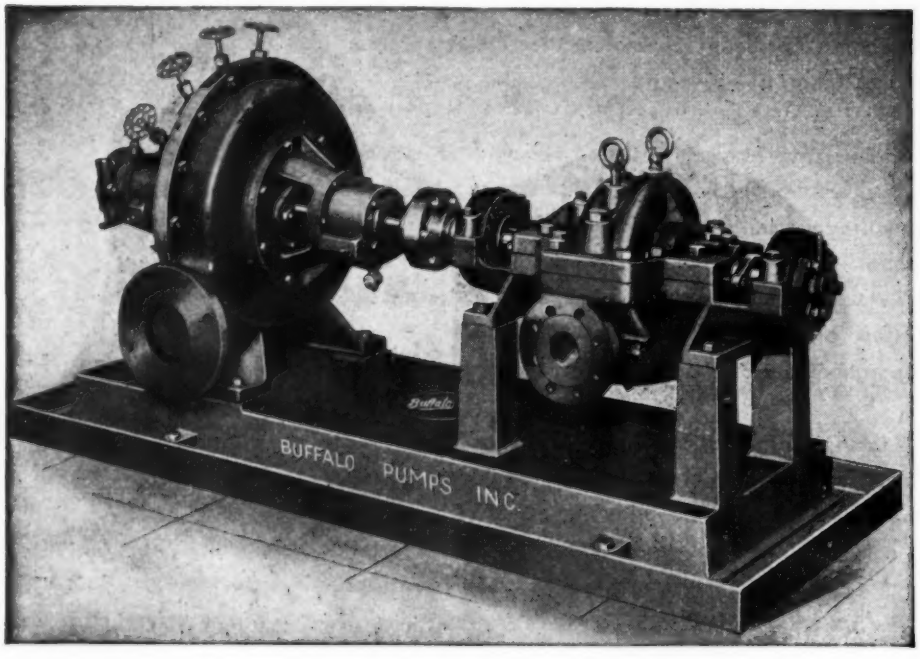

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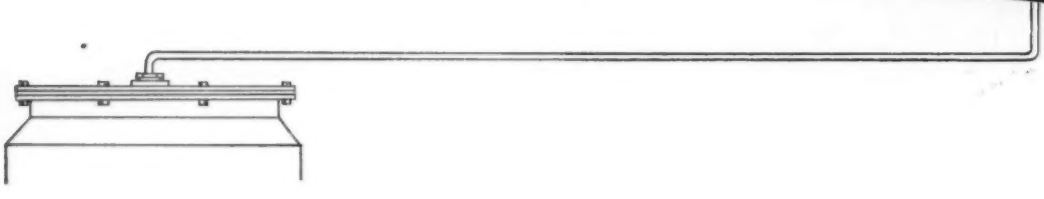
Taylor Accuratus

Thermal Systems



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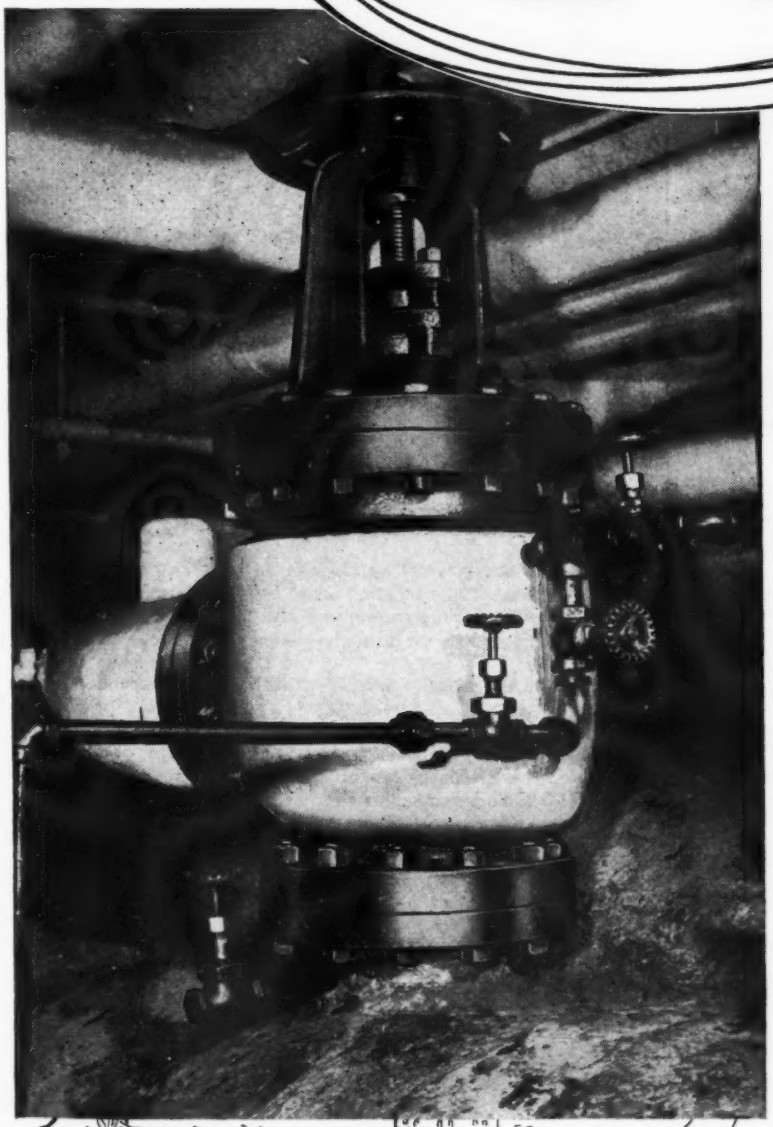

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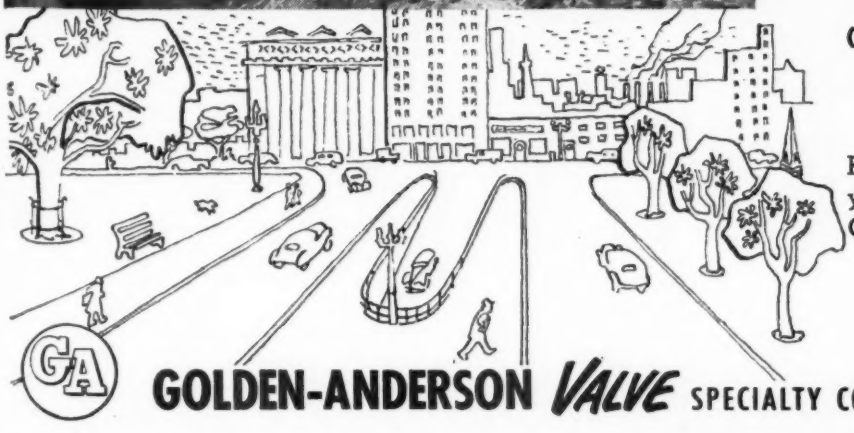

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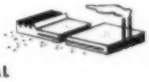

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MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company "Bridgeport" *Headquarters for BRASS, BRONZE, and COPPER*

The Selection and Maintenance of Evaporator Tubing

Wide Range of Copper-Base Alloys To Resist Corrosion

Aside from the maintenance of condenser tubes in steam surface condensers, operators in power plants, land stations and on ships have the problem of selecting and maintaining tubing in many other types of heat exchangers. Tubes of various alloys are the functional elements of important auxiliary equipment such as evaporators, feed water heaters, lube oil coolers, generator coolers, boiler blow-down heat exchangers, condensate coolers, fuel oil heaters, economizers, gland steam condensers, inter and after coolers, etc. Different alloys are required to successfully withstand the various types of corrosive attack, wide temperature ranges, and extreme variations in pressures. Since the breakdown of any one unit due to failure of the tubing may lead to reduced operation or serious shutdown, the selection of the tubing alloy which will stand up satisfactorily is most important.

Clean Boiler Water Essential

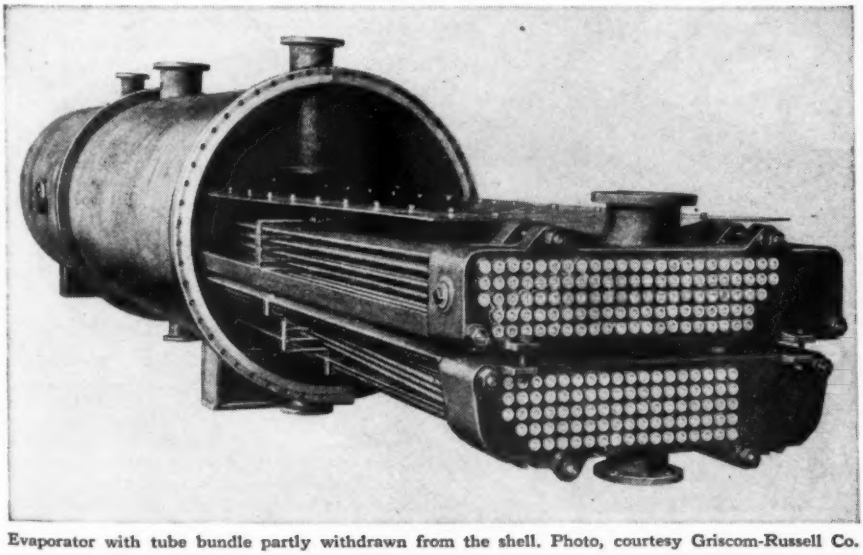
The trend toward higher and higher steam pressures in power plants calls for very pure feed water to minimize scaling and corrosive attack.

The most widely used method for removing objectionable dissolved and suspended solids is through evaporation of the incoming water. For this purpose the shell and tube type evaporator is generally used. Here the tubes are either straight or coiled.

The steam leaving the evaporator is piped to a heat exchanger which is tied into the feed water heating circuit. The solids or suspended matter are left behind in the evaporator in the form of sludge or scale which can be easily removed. The distilled water is regarded as being very desirable because it contains practically no solids.

The use of distilled water does not mean that boiler water conditioning is not required. But it does follow that definite reduction in boiler difficulties is obtained since the brunt of corrosive attack is transferred from the boiler to the evaporator. In the boiler, tube burn-outs are considerably less likely to occur when scales do not form on the surface of the boiler tubes.

Where an adherent scale forms on the evaporator tube surface it is loosened by heating the tubes with steam, then shocking them by the passage of cold water. This cracks or peels off the scale. If feasible, pretreatment of the water going to the evaporator appears desirable since it reduces the frequency of evaporator cleaning.



Evaporator with tube bundle partly withdrawn from the shell. Photo, courtesy Griscom-Russell Co.

Excessive Corrosion Through Hot-Wall Effect

Occasionally, corrosion pitting, localized beneath deposits of sludge or scale, may be encountered on the evaporator tube surfaces. This is known as the "hot-wall effect."

Briefly, the mechanism of the hot-wall effect consists of the formation of hot spots under bubbles of gas, salts or debris which act as heat insulating barriers and hinder the water from cooling the metal surface. The temperature beneath the gas-bubble or deposit approaches that of the steam and this relatively high temperature markedly accelerates the rate of corrosion at that point. In evaporators deposits should be removed as often as possible in order to constantly shift the points of attack.

Copper-Base Alloys Are Corrosion-Resisting

Evaporator tubes must be able to withstand the combined action of steam on their inside surfaces and the salt-laden water on their outside surfaces. The high concentration of salts which accumulates in the evaporator requires that the hot metal surface be capable of withstanding the action of these salts. The concentration and nature of the salts varies from one locality to another. In inland power stations using fresh water, metals such as Copper, Admiralty, Red Brass and Muntz Metal are giving excellent service. On board ship, using sea water, Copper evaporator tubes have been very extensively used for years. Recently 70-30 Cupro Nickel has been used in increasing quantities in the form of sheet for shells, heads, and tube sheets; tubing and piping for use in contact with sea water.

On the basis of the performance of Duronze IV* (arsenical aluminum bronze, 95% copper, 5% aluminum) in handling strong salt solutions in evaporators in salt refineries, it appears likely that this alloy will have more extensive application in connection with feed water evaporators.

More detailed information concerning the composition and characteristics of Bridgeport condenser and heat exchanger tube alloys is given in Bridgeport's 120-page Condenser Tube Manual. For technical assistance in the selection of the alloy which will best serve you we offer assistance from our experienced laboratory staff. Contact our nearest District Office for any services we can render.

*U. S. Pat. No. 2,093,380

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Fig. 21 Fig. 22

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Fig. 47

Fig. 13
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Fig. 12

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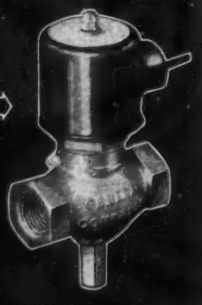

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Capacity of Chemical Tank—10 gallons.

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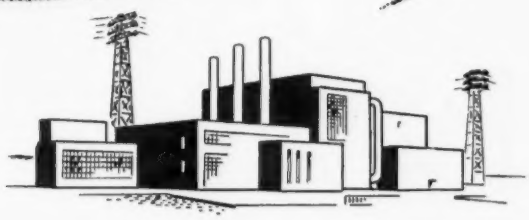

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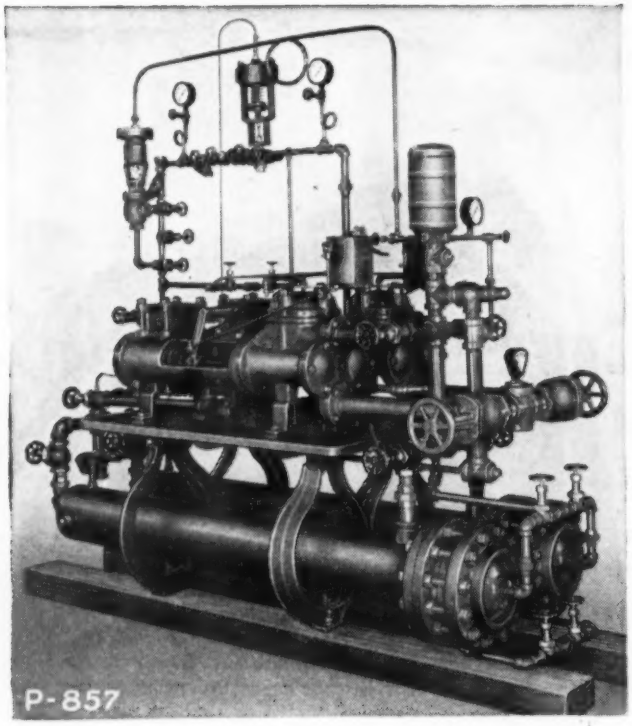

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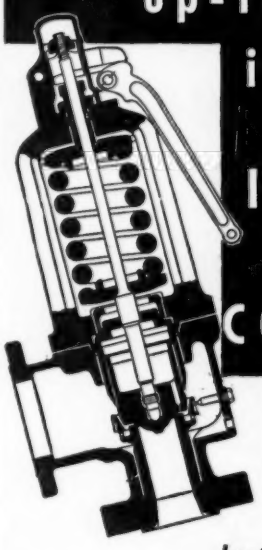

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NORTON REFRACTORIES

WHEREAS Norton Special Refractories are a match for the high temperatures found in many industrial operations, the popularity of Norton's CRYSTOLON Brick for use in boiler furnaces can be attributed to much more than their refractoriness. CRYSTOLON Brick have a very hard surface and a very dense surface in the sense of low porosity and permeability. These brick not only are resistant to abrasion caused by the moving fire bed, but also their dense surface resists the penetration of molten slag. The original surface of the brick remains unaffected for long, trouble-free service. These brick are made with a high percentage of top quality silicon carbide plus a small percentage of refractory bond. They possess great refractoriness, great strength at elevated temperatures, and strong resistance to spalling. CRYSTOLON Brick will pay for themselves through elimination of both maintenance cost and difficulties that result in lost time. The Refractories Division of Norton Company has specialized in tough, high temperature problems. We are glad to specify the correct Special Refractories for your plant.

NORTON COMPANY, WORCESTER 6, MASS.

HOPPES
FEEDWATER HEATERS

Deaerating and Non-Deaerating

Write for Bulletin

The Hoppes Mfg. Co., Inc.

Established 1881

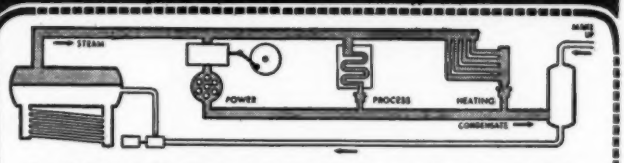
SPRINGFIELD OHIO

DIESEL ENGINES

A SPECIAL SECTION

In its April issue, POWER will commemorate the 50th Anniversary of the American diesel engine with a comprehensive survey of modern engines. Watch For It!

Stop CORROSION in your Steam System



The CORAVOL-ZONE—indicated by the shaded area in the diagram—includes every part of a steam system not accessible to boiler feed water treatment. It includes the boiler above the water line, steam lines, condensate return lines, radiators, valves, traps and equipment. This zone can now be reached and protected against rust and corrosive action—by CORAVOL.

CORAVOL BOILER

SAVES YOU COSTLY
Pipe Repairs, Replacements, Maintenance Labor, Hours and Days of Shutdown Loss

CORAVOL in your steam system (1) prevents corrosion in steam and condensate lines, (2) cleans out clogging rust deposits resulting from previous corrosion. Thus, CORAVOL *protects lines;* increases effectiveness of heat transfer surfaces; restores original capacity of lines and the operating efficiency of valves and traps.

CORAVOL is *not* a boiler feed water treatment—it is designed expressly for use in steam systems. Because CORAVOL volatilizes and condenses with the steam, it circulates throughout your entire steam system and protects *all* zones from corrosive attack.

***The use of CORAVOL** in steam systems is covered by U. S. patent No. 2053024. The Western Chemical Co., owner of this patent, grants licenses under which volatile amines purchased from other sources may be used in steam systems upon payment of royalty to Western Chemical Co.*

WRITE TODAY for complete FREE data about the CORAVOL process.

CORAVOL is part of a complete technical service which provides special formulas of treatment for:
Boiler Feed Water . . . Hot Water Supply . . . Refrigerating Brine . . . Cooling and Condenser Water . . . Rapid Scale Removal . . . Coagulation . . . Algae Control.

57 Years of Experience in the Chemical Treatment of Water

WESTERN CHEMICAL CO.
713 WASHINGTON KANSAS CITY, MO.

One of a series *of messages to help you increase your understanding of business paper advertising, and its effect on your business.*

Why you and your advertising manager are partners

FROM WHERE YOU SIT, advertising may look like the "glamour department" of your company—necessary, of course, but pretty far removed from the hard-headed realities of the production line.

But take a closer look. In one respect, the advertising manager's job bears a striking resemblance to your own.

You're production-minded. You're concerned with anything that will improve plant procedures, speed up assembly time, prevent waste, and reduce the manufacturing cost per unit.

And that is precisely where you walk arm-in-arm with your advertising manager. Because he thinks the same way about the *manufacture of a sale.*

The whole process of selling and distribution are his assembly line. And every time he can reduce the unit cost of a sale by so much as a few cents, he increases your company's chance to show a profit.

Ask him for a definition of advertising, and he will probably tell you that it is simply *mechanized selling,* a machine that multiplies the productive capacity of the sales force — seeking out prospects, arousing their interest, creating a preference for the things your company makes.

And when it is concentrated among the hand-picked readers of business papers, advertising becomes the most efficient machine this partner of yours has found for lowering the cost of producing a sale.

What are the ten ways to measure the results of your business paper advertising? You'll find the answers in a recent ABP folder, which we'll be glad to send you on request. Also, if you'd like reprints of this advertisement (or the entire series) to show to others in your organization, you may have them for the asking.

POWER

is one of the 129 members of The Associated Business Papers, whose chief purpose is to maintain the highest standards of editorial helpfulness—for the benefit of reader and advertiser alike.

ELIMINATE SILICA DEPOSITS ON TURBINE BLADES

● Here's why ILLCO-WAY "SOLIDS-FREE" WATER for boiler make-up is used more and more by central stations and high-pressure industrial steam:

1. To eliminate turbine blade deposits caused by presence of silica.
2. To eliminate deposits on evaporative surfaces.
3. To eliminate shut-downs for turbining and cleaning.
4. To maintain boiler-water concentrations at an extremely low level.
5. To secure high-quality steam free from carry-over.
6. To reduce boiler blow-down to an insignificant degree.

"SOLIDS-FREE" WATER formerly available only by evaporation, is now readily available, *at a fraction of the cost of evaporation,* by means of ILLCO-WAY De-ionizing Equipment.

Power plant engineers and other operating executives are turning, more and more, to the ILLCO-WAY method for solution of boiler water conditioning problems. Why don't you investigate?

For practical application of ILLCO-WAY's synthetic-resin technology and design developments, write for latest literature today.

ILLINOIS WATER TREATMENT COMPANY
853-2 Cedar Street, Rockford, Illinois • 7310-NN2 Empire State Bldg., New York City

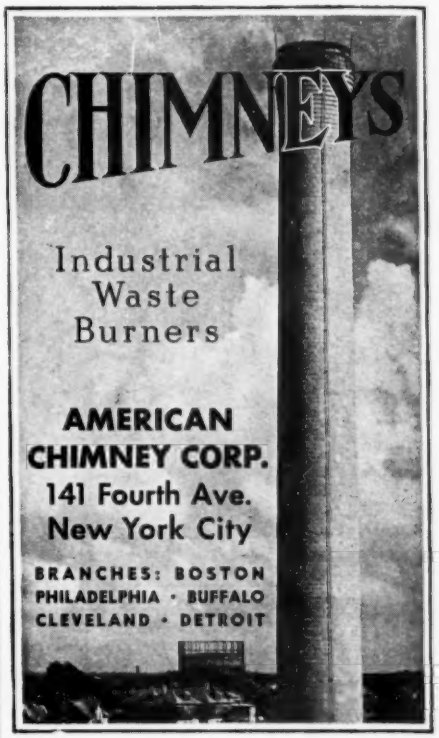
ILLCO-WAY
ionXchange

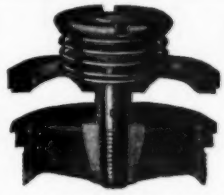
Water Treating Equipment

Complete equipment for Chemical Processing: Purification of industrial wastes, Separation of Chemical Solutions, Purification of Chemical Solutions, Reclamation of Valuable Constituents

WHERE TO BUY

Featuring additional products and specialties for power plants





BIRCH
Pump Valves
•
Standard In
RAILROADS, MINES, WATER WORKS INDUSTRIALS
• They increase efficiency, capacity, economy—decrease slippage, leakage, fuel consumption—will not sink in seat ports, warp, break, curl, or ride seat bridges. For hot or cold water service . . . thoroughly dependable.
BIRCH MANUFACTURING CO.
1521 Sedgwick St., Chicago, Ill.

"MONO"
BOILER BAFFLES
HIGH TEMPERATURE
Refractory Cements
SANFORD C. SMITH REFRACTORIES, INC.
1715 NIAGARA ST., BUFFALO, N. Y.

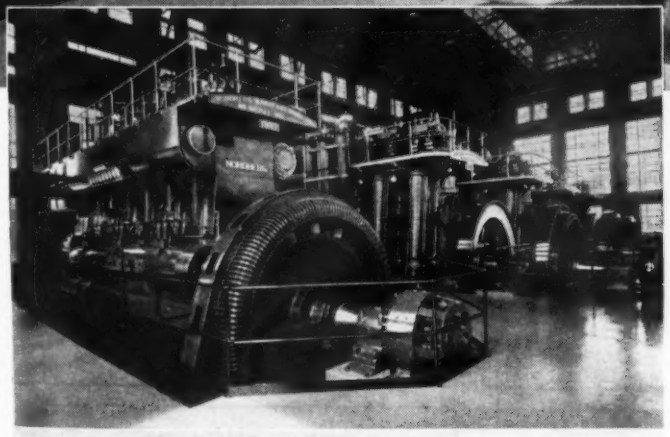
A Good Habit

This Where To Buy Section supplements other advertising in this issue with additional announcements of products and materials of special interest and application in electrical construction, maintenance and repair. Make a habit of checking this page each issue.

NORDBERG GAS DIESELS

Cut Fuel Costs 65%

onca City, Oklahoma placed this 2400 horsepower Nordberg gas burning Diesel in service in 1947



In this plant there are also four 1250 horsepower oil burning Nordberg Diesels installed between 1923 and 1928 and a 2400 horsepower installed in 1937 but now converted to gas, making a total installed horsepower of 9800.

• The municipal power plant at Ponca City, Oklahoma during its twenty-five years of service to the community has always been outstanding as a producer of low cost power. Plant Superintendent Pat Schlesinger reports a saving of 65 percent in fuel costs of the new gas burning Nordberg Diesels as compared to the oil burning engines. For dependable low cost power, investigate the merits of Nordberg Diesel power.

NORDBERG MFG., CO.
MILWAUKEE 7, WISCONSIN

BUSCH-SULZER DIVISION OF NORDBERG

NORDBERG DIESEL ENGINES

NORDBERG MACHINERY

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CONSTRUCTION · PLANS · SURVEY • REPORTS · TRADE MARKS

BURNS & McDONNELL ENGINEERING COMPANY
Consulting Engineers 40th Year
Power Plants - Steam - Diesel - Hydro
Electric Systems - Rate Reports - Valuations
Water and Sewer Systems and Treatment
Box 7088, Country Club Station,
Kansas City 2, Missouri

JOHN R. McDERMET
Consulting Engineer
Corrosion
Control and Prevention
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HARRY M. SPRING, JR.
Registered Professional Engineer
Member A.S.M.E.
Boilers, Pressure Vessels and Steam Plant Problems a Specialty. Possibly we can serve you by mail.
280 Pleasant St., Canton, Mass.
Tel: Canton 6-0247

ELECTRIC CONSTRUCTION CO. INC.
Engineers—Contractors
Design—Erection—Maintenance
of
Power Plant, Sub Stations
Transmission and Distribution Lines
Modern Equipment
Philadelphia, Pa.

LUKE L. NAKASHIAN
Engineer
PROCESS STEAM PLANTS
POWER PLANTS
OIL REFINERY EQUIPMENT
404 Park Square Building Boston 16, Mass.

STANLEY ENGINEERING COMPANY
CONSULTING ENGINEERS
Power Plants
Steam - Diesel - Hydro
Design - Construction - Test - Valuation
Hershey Building Muscatine, Ia.

GILBERT ASSOCIATES, INC.
ENGINEERS AND CONSULTANTS
Industrial and Utilities. Power Plant Design and Construction, Rehabilitation and Maintenance.
Steam — Diesel — Hydro
Reports — Examinations — Laboratory
New York, N. Y. — 61 Broadway
Philadelphia, Pa. — 17 & Sansom St.
Washington, D. C. - 1417 "K" St., N.W.
Reading, Pa. - 412 Washington St.

PUBLIC UTILITY ENGINEERING & SERVICE CORPORATION
CONSULTING ENGINEERS
Design Operations
Steam - Hydraulic - Gas
231 S. LaSalle St. Chicago (4), Ill.

JOHN A. STEVENS, INC.
Established 1900
CONSULTING ENGINEERS
Power Plants Paper Mills
Dye Houses Surveys
Lowell, Massachusetts

KEGARISE-CRONK ENGINEERING CORP.
Engineers - Consultants
Power Plants — Industrial Plants
Steam and Electric Distribution Systems
Steam and Electric Utilization
Design — Reports — Plans
334 E. Main St. *P.O. Box* 668 Johnson City, Tenn.

REYNOLDS, SMITH AND HILLS
ENGINEERING CONSULTANTS
Specialists in Design and Construction of Industrial and Central Station Plants
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SYSKA & HENNESSY
Engineers
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New York, New York

THE KULJIAN CORPORATION
Engineers - Constructors
Power Plants and Industrial Projects
1518 Walnut Street, Philadelphia 2, Pa.
New York 6 Washington 5

SANDERSON & PORTER
Engineers and Constructors
New York Chicago
San Francisco Los Angeles

JAMES ALLEN TUCK
Consulting Engineer
Design - Power Plants
Industrial & Utility
Diesel, Steam, Hydro
Also Central & Sub-Station
41 Park Row, N. Y., N. Y.
Phone: Barclay 7-2796

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Suite 456, 815-15th St. N.W., Washington 5, D. C.

SARGENT & LUNDY
ENGINEERS
140 South Dearborn St. Chicago, Illinois

THE J. G. WHITE ENGINEERING CORPORATION
Design-Construction-Reports-Appraisals
80 Broad Street, New York 4

T. MASENG & ASSOCIATES, INC.
Engineer
Electrical, Design · Structural, Reports · Mechanical Rates
7 So. Dearborn Chicago 3, Ill.

J. E. SIRRINE COMPANY
Engineers
Power Plants Consultations
Design Reports
Water Steam Utilization Plans
Greenville South Carolina

WHITMAN, REQUARDT AND ASSOCIATES
Engineers - Consultants
Power Plants — Industrial Plants
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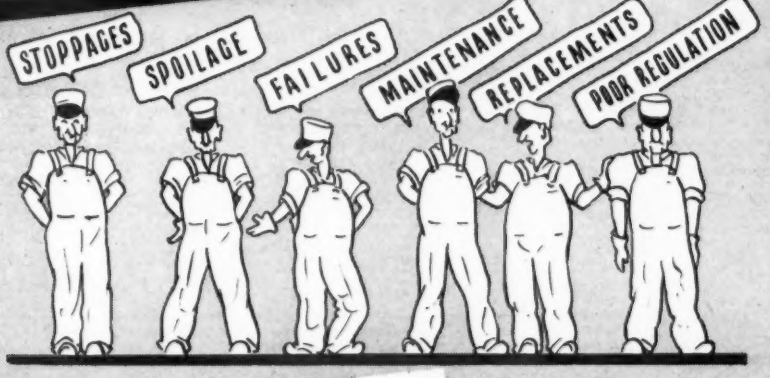
Waterworks and Sewerage
Reports - Plants - Supervision - Appraisals
1304 St. Paul Street Baltimore 2, Md.

THE REAL VALUE

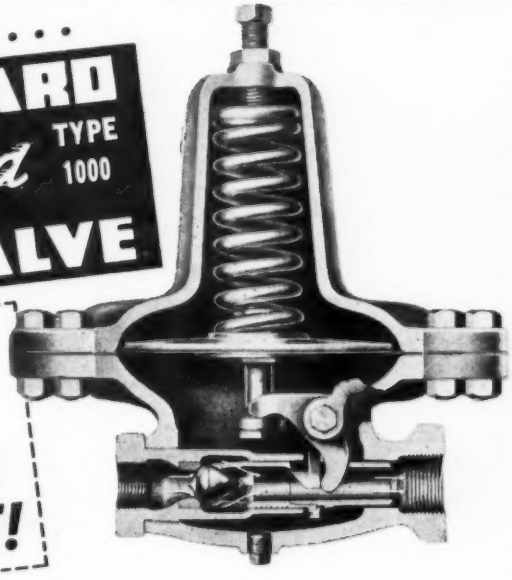
of placing your unusual problem in the hands of a competent consultant is that it eliminates the elements of chance and uncertainty from the problem and provides real facts upon which to base decisions.

THESE ARE THE TROUBLEMAKERS YOU WISH TO STOP . . . .



HERE IS THE VALVE THAT WILL STOP THEM . . . .

CASH STANDARD *Streamlined* TYPE 1000 PRESSURE REDUCING VALVE



THIS IS THE BULLETIN (No. 962) THAT TELLS YOU WHY . . . .

SEND FOR IT!

and here is proof from a user . . . .

"We are more than satisfied with our STREAMLINED Valve performance. They are all over this plant and, frankly, I have forgotten about most of them as I never have any trouble.

"What I like about these valves is that in some cases our initial pressures vary considerably, yet the reduced pressure is held steady. This work is all processing and is very important.

"Your competitors will have a hard time convincing me there is a better valve to be had."

THESE ARE THE BENEFITS YOU GET BECAUSE OF ITS ASPIRATOR AND STREAMLINED FLOW . . . . .

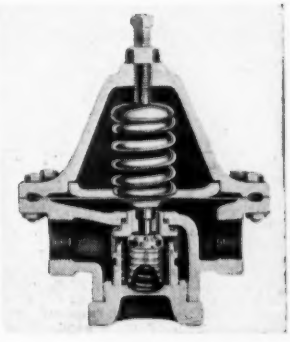
Maximum Capacity When Needed Most • Accurate Pressure Control Under Toughest Working Conditions • Trouble-Free Service • Smooth Operation • Tight Closure • Accurate Regulation • Speedier Production Results • Elimination of Failures • Constant Delivery Pressure • Cost Saving Operation • No Spoilage • Practically Zero in Maintenance Costs.

CASH STANDARD CONTROLS.. VALVES

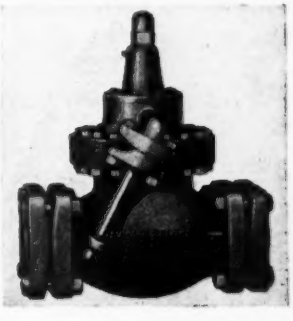
A. W. CASH COMPANY
DECATUR, ILLINOIS

BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES

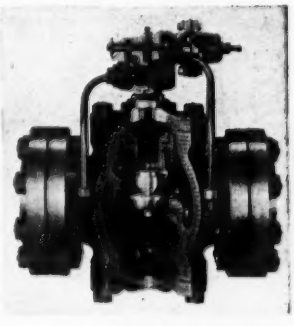
Send for them



Bulletin 950—features the CASH STANDARD Type D Single Seat Pressure Reducing and Regulating Valves for use with most fluids. Shows simple inner working parts that save in maintenance. Diagram explains how valve works. Blueprint shows simplicity of installation.



Bulletin 956—features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.



Bulletin 966—features the CASH STANDARD Self-Contained, Pilot Operated Type 10 Pressure Reducing and Regulating Valve for use with water or air; with any gas or oil that is non-corrosive; and with refrigerating fluids such as Ammonia and Freon. Many interesting particulars explained such as: how valve works, tight seating, large capacity, no waste, no water hammer or chatter.

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EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

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(Not available for equipment advertising)
$1.20 a line, minimum 4 lines. To figure advance payment, count 5 average words as a line.
POSITIONS WANTED (full or part-time individual salaried employment only), ½ the above rates.
PROPOSALS, $1.20 a line an insertion.

INFORMATION

BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 1 line additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED RATE:

The advertising rate is $10.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅛ inch vertically on one column, 3 columns—30 inches—to a page. P.

NEW ADVERTISEMENTS received by February 9th will appear in the March issue, subject to limitation of space available

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (18)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

WANTED GRADUATE electrical or mechanical engineer having several years experience with boiler and turbine operation to take complete charge of Power Plant. Submit full details with application. Crosby Chemicals, Inc., Picayune, Mississippi.

BOILER ROOM Foreman wanted by food processing concern to take charge of boiler room operation. Must have technical knowledge of combustion and practical experience in the operation and maintenance of medium pressure boilers, spreader type stokers and boiler room auxiliaries and instruments. Location Detroit. Application should furnish vital statistics, outline of education and experience and salary expected. P-3458, Power.

GRADUATE MECHANICAL Engineer wanted: Test and efficiency engineer with educational background such that he can be trained to make tests and analyze performance data in a modern steam power plant. Permanent position with a well known electric utility in Northwestern Ohio. Good opportunity for advancement. Write full particulars about age, experience, education, salary requirements to P-3449, Power.

POWER COMPANY operating interconnected system with numerous plants in three states in North Central United States is looking for experienced man, age 30 to 40 years of age to serve as Load Dispatcher. Must have technical training and background in utility operation. Headquarters in city of 12,000. Permanent position with locally controlled and operated company for the right man. Applicants should state complete history of experience and education, previous positions held and duration with reasons for changes. Include photograph and references. State salary expected. Otter Tail Power Company, Fergus Falls, Minnesota.

SELLING OPPORTUNITIES OFFERED

PROMINENT CHIMNEY concern desires agent Cleveland, Ohio, territory contacting industrial plants and engineers; write giving full particulars. RW-3567, Power.

SALES ENGINEER power chemicals division of large chemical manufacturing organization has opening for representatives in east, south and mid-west for sale of industrial water treatments—prefer men with experience or suitable chemical background. Salary, expenses and bonus arrangement—send full particulars for interview—all replies confidential. E. F. Drew & Co., Inc., 15 E. 26th Street, New York 10, N. Y.

EMPLOYMENT SERVICES

SALARIED POSITIONS $3,500 and upward. If you are considering a new connection communicate with the undersigned. We offer the original personal employment service (38 years recognized standing and reputation). The procedure, of highest ethical standards, is individualized to your personal requirements and develops overtures without initiative on your part. Your identity covered and present position protected. Particulars on request. R. W. Bixby, Inc., 270 Dun Bldg., Buffalo 2, N. Y.

SALARIED PERSONNEL, $3,000-$25,000. This confidential service, established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. G, 241 Orange St., New Haven, Conn.

POSITIONS WANTED

GRADUATE ELECTRICAL and Mechanical Engineer. Twenty years of experience in installation and management of diesel and hydroelectric power plants, substations, public utility and industrial maintenance, serving as power plant superintendent in border city of Mexico desires change. Would accept representative or executive position in any Spanish or English speaking country. Will furnish best references and resume of experience to interested Corporations. PW-3190, Power.

MACHINE SUPERVISOR

Large merchandise organization has opening for a Clerical Machine Repairman Supervisor. Should have complete knowledge of all intricate and complicated business machines in addition to typewriters, adding machines, and ediphones. Layout of work, ability to make improvements, and the ability to follow a job through to completion are desirable. Experience in supervising men is essential as this job requires direct supervision of 15 to 20 highly trained Mechanics and 2 Foremen. State experience, age, education, and salary requirement in first letter.

P-3532, Power
520 North Michigan Ave., Chicago 11, Ill.

WANTED
ENGINEERS

Electrical & Mechanical Engineers and Draftsmen. Experienced in design of steam plants and sub-stations. For work in San Francisco and Los Angeles. Ideal climate and living conditions. State salary desired and give details of education, experience, age and availability.

P-3572, Power
68 Post Street, San Francisco 4, Cal.

POSITIONS WANTED

BOILER SALES graduate engineer over 10 years experience and excellent training desires Central or South American position. PW-2691, Power.

MECHANICAL MAINTENANCE supervisor, 42 years old, 23 years in steam electric power plants, 10 years in supervision utility co. plants. Am not a graduate engineer but have worked consistently learning the technical aspects of my job. Am seeking position in mechanical maintenance or as manufacturers service engineer. Any location considered. Let us discuss your need and my qualifications. PW-3580, Power.

SELLING OPPORTUNITY WANTED

SALES REPRESENTATION Available—New Orleans. Established Manufacturers' agent seeks additional reputable line. Familiar with territory; experienced in sales. Geo. Keller, 328 Exchange, New Orleans, La.

SALESMAN

to represent a long established national concern with outstanding line of industrial efficiency chemical products for manufacturing plants, public institutions and property managers. Splendid opportunity for man with car. Engineering background or mechanical aptitude helpful. Frequent repeat business. Generous commissions paid weekly to start with. Drawing accounts arranged after salesman proves ability. Give full details of experience, qualifications, etc.

Universal Refining Products Co., Inc.
1133 Broadway, New York 10, N. Y.

OPPORTUNITY AHEAD

An international organization in the combustion control field has openings for field representatives. The men we are looking for must be accustomed to earning at least $10,000 a year on commission. They must be qualified to analyze steam power plant engineering problems and present solutions based on instruction from our services offered. We are looking for men seeking permanent positions rather than "just jobs". Some leads will be furnished, some accounts assigned. Car is necessary.

No applications will be considered unless full details of past experience are truthfully given in a letter which will be held in strict confidence. Reference will be checked only after interview. Excellent territories open throughout the United States.

SW-3545, Power
330 West 42nd Street, New York 18, N. Y.

Mechanical Design Engineer

With Administrative Experience in the Design of Steam Electric Stations
Preferably Between 35 and 45 Years of Age
LARGE EASTERN UTILITY
All Replies Strictly Confidential

P-3323, Power
330 West 42nd Street, New York 18, N. Y.

MECHANICAL ENGINEERING REVIEW

Complete Refresher and Coaching Course for Professional Mechanical Engineers, State lisense examinations. Thoroughly reasonably priced. For details write

"ENGINEERING REVIEW"
Box 424, Cincinnati 1, Ohio

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Single Items or Complete Plants Purchased and Dismantled. Men—Tools—Insurance—30 yrs. Experience.

Boilers — Engines — Generators — Compressors. Power Plant and Material Handling Equipment Bought and Sold.

We also contract to dismantle, skid and box equipment of all kinds for re-erection to dismantle, scrap and remove obsolete equipment.

"We can dismantle anything made of metal"

G. M. Linder & Co.
Plant Dismantlers & Contractors
322 E. 33rd St., New York 16, N. Y.
Telephones Murray Hill 6-9635 / Queens—Bayside 9-2121 } ***Day or Night***

A STANDARD OF QUALITY THAT IS NEVER LOWERED

Electrical Equipment

rebuilt and tested by our Electrical Engineers TO N. I. S. A. STANDARDS

MOTOR GENERATOR SETS

1—125 KW Crocker Wheeler 125 V. 1200 RPM. 2300 V., Squirrel Cage.
1—100 KW Elec. Mach. 125 V., 1200 RPM 4150 volt, synchronous.
1—100 KW General Electric, 230 v., 900 RPM. TS 4150 v. syn.
1—50 KW Ridgeway 1200 RPM. 550 Volt, Motor Sq. Cage, 220 volt.
1—5 KW General Electric, AC Gen. 1800 RPM. 120 volt, single phase, DC Motor, 230 volt.
4—100 KW General Electric, 60 volt, 1200 RPM. 125 HP Squirrel cage 220/440 volt.

ENGINE GENERATOR SETS

1—150 KVA General Electric, Ames Uniflow 220 volt, 3 phase, non-condensing.
2—13 x 15 Uniflow Engines 150/300 RPM. for Ice Compressors.
1—200/273 volt Gasoline Van Bierck 8 cyl. 1500 RPM.

TURBO GENERATOR SETS

1—300 KW General Electric ATB 240 Volt, 3 phase, condensing.
1—30 KW Allis Chalmers 3600 RPM. 125 volt, Terry Non-condensing.

PLATING SETS

1½ KW G.E., 1800 RPM. 5/6 volts, squirrel cage motor.
12 KW Hanson Van Winkle 24 volt with exciter, 1200 R.P.M. with squirrel cage motor.

TRANSFORMERS

3—200 KVA General Electric, Type H, 2400 volt primary, 120-240 secondary.
1—200 KVA Pittsburgh 4000 volt, single phase 110/220 volt secondary.
1—1000 KVA General Electric Auto transformer, 3 phase, 4150 volt, 3 phase, 2406 volts.
3—50 KVA, G.E., 2400 primary, 120/240 secondary.
1—100 KVA Westinghouse, 13200 volt, 250 volt, single phase.
3—75 KVA 440 to 220 primary, 120 to 240 secondary.
46—50 KVA Westinghouse, 13,800 primary, 120 volt secondary.
35—50 KVA G.E. 13,800 primary, 120 volt secondary.
5—50 KVA Westinghouse, 13,800 primary, 125 volt secondary.
5—50 Westinghouse 12,800 primary, 240/120 secondary.
10—27½ KVA General Electric brand new Air Cooled 440/220 220/110 single phase.
3—10 KVA Westinghouse Air Cooled, 450 volt, primary, 117 Volt secondary, single phase.

A. C. GENERATORS

500 KW General Electric .8 PF, 3600 RPM. ATB, 600 volts, DC exciter
240 KW General Electric .8 PF, 600 RPM. ATB, 600 volts, DC exciter.
200 KVA Allis Chalmers, 3600 RPM. 240 volt, 2 phase, DC exciter.
200 KVA Westinghouse, 600 RPM. 240 volt, 3 phase, DC exciter.
200 KVA Allis Chalmers, 900 RPM. 240 volt, 3 phase, DC exciter.
150 KW Westinghouse, 514 RPM. .8 PF. 550 volt, 3 phase.
2—167 KVA General Electric, 1200 RPM. .6 PF. 450 volt, 3 phase.
165 KW Electric Machinery, 514 RPM. 240 volt, 3 phase.
120 KW General Electric, ATB, .8 PF. 720 RPM. 2300 volt, 3 phase.
100 KW General Electric, ATB, 600 RPM. 240 volt, 3 phase, DC exciter.
62½ KW Allis Chalmers, 3600 RPM. 220 volt, 3 phase, DC exciter.
35 KW Columbia Elect. .8 PF. 1200 RPM. 240 volt, 2 phase, DC exciter.
31.3 KVA American Customs, .8 PF. 1200 RPM. 120/208 volt, 3 phase, DC exciter.
12.5 KVA Westinghouse, .8 PF., 1200 RPM. 240 volt, 3 phase, DC exciter.

SYNCHRONOUS MOTORS

150 HP General Electric, T.S. 900 RPM. 4160 volt, 3 phase, DC exciter.
75 HP. 1200 RPM. General Electric, 440 volt, 3 ph., DC exciter.
70 HP Electric Machinery, 180 RPM. 2300 volt, 2 phase.
40 HP Westinghouse, 1800 RPM. 220 volt, 3 phase, DC exciter.
35 HP General Electric, 1200 RPM. 2300 volt, 3 phase, DC exciter.
20 HP Westinghouse, 1800 RPM. .8 PF. 220 volt, 3 phase.

MOTORS—3 ph. 60 cycle
SQUIRREL CAGE

1—750 HP General Electric, 750 RPM, 6600 volt, 3 phase, 25 cycle.
1—150 HP General Electric IK, 450 RPM, 440 volt.
1—125 HP U. S., 1200 RPM, vertical hollow shaft, 220 volt, 3 phase, 60 cycle.
1—450 HP Ridgeway 900 RPM, 2200 volt, 3 phase.
1—75 HP Westinghouse, 1800 RPM, 2200 volt.
1—75 HP General Electric, Type KT, 1200 RPM, 440 volt.
1—60 HP Westinghouse, 900 RPM, Type CS, 220 volt.
3—40 HP General Electric, Type KT, 900 RPM, 220 volt, 3 phase.
1—35 HP General Electric, Type 1, 600 RPM, 550 volt, 3 phase.
2—10 HP Westinghouse gear 440 RPM, output 440 volt, 3 phase.

MOTORS—3 ph. 60 cycle
SLIP RING

1—450 HP General Electric, 425 RPM, ITC, 440 volt, 25 cycle.
1—100 HP General Electric, 720 RPM, IM, 440 volt, 25 cycle.
1—60 HP, General Electric, 600 RPM, MT, 220 volt.
1—50 HP, General Electric, Type MT, 600 RPM, 220 volt.
1—50 HP F & B, 1800 RPM, BV, 220 volt.
1—50 HP General Electric, 900 RPM, IM, 440 volt.
1—40 HP Cont. 1150 RPM, SA55, 220 volt.
1—40 HP General Electric, 1130 RPM, MT, 220 volt.
1—40 HP General Electric, 900 RPM, MT, 220 volt.
1—40 HP General Electric, 900 RPM, MTI, 2000 volt.

JLHC

THIS SEAL IS YOUR GUARANTEE

"FOR POWER"

J. L. HEMPHILL & CO.

1604 53rd STREET, NORTH BERGEN, N. J.

PHONE NEW YORK—LONGACRE 5-3227

PHONE NEW JERSEY—UNION 3-2600

RE-NU-BILT BELYEA MOTORS

Behind this name

RE·NU·BILT

ELECTRICAL EQUIPMENT REBUILT BY SPECIALISTS

BELYEA

THE TRADE MARK that means "SUCCESSFUL OPERATION GUARANTEED"

SPECIAL General Electric Spirakore transformers 167 KVA, 2400/4160Y volt primary, 120/240 volt secondary, single phase 60 cycle, OISC. Can also furnish 240/480 volt secondary. Newly wound. Can also furnish with 600 v. sec.

THE NAME that says: "OUR REPUTATION IS YOUR PROTECTION"

MOTOR GENERATOR SETS

3 ph. 60 cycle

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
1	1500	G.E.	600	600	2300/4150
1	1000	Cr. Wh.	720	600	2300/4150
1	1000	West.	514	250	4150
1	1000	G.E.	900	600	2300/4150
2	1000	Whse.	900	600	6600/12500
1	1000	Al. Ch.	720	450	2300
2	750	Whse.	900	275	6600
1	750	G.E.	900	275	2300/4150
2	500	G.E.	720	600	2300/4150
1	500	G.E.	720	600	6600/13200
1	500	G.E. (3 u)	1200	250	440
1	500	G.E.	720	600	4400
1	400	G.E. (3 u)	720	125/250	2300
2	400	Whse.	1200	250	440/2300
1	300	G.E.	720	550	2300/4000
1	250	G.E.	720	75	2300/4000
2	250	G.E.	1200	250	440
1	200	G.E.	720	125	440
1	100	G.E.	1165	250	440
1	100	G.E.	1170	125	220
4	90	G.E.	1180	60	220/440
2	75	Cr. Wh.	1160	250	220/440
1	75	G.E.	1180	125	2300/4000
1	60	Cr. Wh.	1750	250	220/440
1	50	G.E.	1145	125	22
1	48	G.E. (3 u)	1750	60	440

FREQUENCY CHANGER SETS

1—1000 KW—GE—2 Unit—3 Brg. Consisting of—1400 HP—4400 V, 3 ph. 25 Cy. Motor and 1000 KW—2300 V. —3 ph. 58.3 cycle gen. with exciter (Gen. can be reconnected for 800 KW 3 ph.)

1—840 KW—GE—2 unit with 2 exciters consisting of 1700 HP—2300 V, 3 ph. 25 cycle motor and 1200 KVA.—.7 pf. 2400 V. 3 ph. 60 cycle gen.

ROTARY CONVERTERS

60 Cycle

KW	Make	Speed	D.C. Volts	A.C. Volts
1—1500	Whse.	720	600	2300
1—1000	G.E.	900	600	11000
1—1000	Whse.	900	600	11000
1— 750	Whse.	900	600	13200
1— 750	Whse.	720	250	6600
1— 500	G.E.	900	250	2300

TURBO-GENERATOR SETS

1—3000 KW Whse. 3750 Kva. 2300 V. 3 ph. 60 cy. with Parsons 200 lb. Cond. turbine.

1—3000 KW G.E. 3759 Kva. 2300 V. 3 ph. 60 cy. with G.E. 200 lb. Cond. turbine.

1—2500 KW G.E. 3125 Kva. 600 V. 3 ph. 60 cy. with 200 lb.; 15 lb. auto extraction turbine.

SPECIAL

1—1500 KW—GE—6600 V, 3 ph. 60 cy. with non condensing 175 lb. ISP and 10 lb. B.P. Turbine and direct connected exciter.

1—2000 KW G.E. 6600 V. 3 ph. 60 cy. with G.E. 175 lb. Cond. turbine and d.c. exciter.

1—1500 KW G.E. 1875 Kva. 480 V. 3 ph. 60 cy. with G.E. 200 lb. Cond. turbine.

2—1250 KW G.E. 1560 Kva. 2300 V. 3 ph. 60 cy. with G.E. 175/200 lb. Condensing turbine.

1—1250 KW Al. Ch. 1560 Kva. 2300 V. 3 ph. 60 cy. with 200 lb. Condensing turbine.

1—1000 KW G.E. 1250 Kva.—2300/4160 V. 3 ph. 60 cy. with G.E. 135/175 lb. Cond. turbine.

1—500 KW G.E. 625 Kva.—240/480 V. 3 ph. 60 cy. with G.E. 200 lb. Cond. turbine.

1—300 KW G.E. 375 Kva. 480 V. 3 ph. 60 cy. with G.E. 200 lb., 10 lb. back pressure turbine.

1—300 KW Al. Ch. 120/240 V. d.c. geared to Whse. 440 lb. Cond. turbine.

1—200 KW G.E. 600 V. 3 ph. 60 cy. with 150 lb. non-cond. turbine and exciter.

1—125 Kva. G.E. 2300 V. 3 ph. 60 cy. with 125/200 lb. Non-Cond. turbine.

1—60 KW Whse., Condensing, 200 lbs. with 60 KW. 120 V. D.C. Gen.

SYNCHRONOUS CONDENSERS

Qu.	Kva.	Make	Type	Volts	Speed
1	4000	Whse.		4150	600
1	4000	G.E.	TSC	2400/4800	900
1	600	G.E.	ATI	600	900
1	500	G.E.	ATI	480	900

SPECIAL

500 HP—GE—KF-559—3575 RPM—2300 Volt Sq. Cy. Motor connected to Byron Jackson 325 GPM—10 stage, 3500 ft. head pump.

A. C. MOTORS

3 ph. 60 cycle

SYNCHRONOUS

HP	Make	Type	Volts	Speed
2—35000	G.E.	TS	2300	257
1—2100	G.E.	ATI	4600	51
2— 900	Al. Ch.	(New)	2200	150
1— 600	G.E.	ATI	600	900
1— 400	G.E.	TS	440	600
2— 350	G.E.	TS	2200	150
1— 100	Whse.		550	600

SLIP RING

1—1000	Whse.	CW	2300	700
1— 900	G.E.	IM	2300	80
1— 750	Whse.	CW	2200	327
1— 450	Cr. Wh.	SR-31	2300	392
1— 450	G.E.	I	440	506
1— 350	G.E.	MT-442Y	2200/4000	253
1— 300	Whse.	CW	440	1750
1— 250	Whse.	CW	2200	500
3— 200	G.E.	IM	440/550	435
1— 250	G.E.	MT-424Y	4000	257
1— 100	Al. Ch.	ANY	240	435

SQUIRREL CAGE

1—700	G.E.	KT	2300	705
1—250	West.	CS-7111	2200	3530
1—250	G.E.	IK	440	600
1—200	G.E.	IK	550	865
1—150/70	G.E.	IK	440	1170/870
1—100	G.E.	IK	2200	600

SPECIAL

MERCURY ARC RECTIFIERS

1—750 KW—GE—Type RHW—6 Anode 575 V, D.C. Form C with 2300 V, 60 cycle transformer and switching equipment.

1—500 KW—GE—Type RHW—6 Anode 575 V, D.C. Form B with 2300 V, 60 cycle transformer and switching equipment.

D. C. MOTORS

HP	Make	Type	Volts	Speed
2—800/1000	Whse.		450	600/720
1—800	G.E.	MPC	600	600
1—765	G.E.	MPC	500	1045/1250
1—700	G.E.	MCF	600	150/225
1—450	G.E.	MPC	250	115/140
1—375	G.E.	MPC	230	450/900
2—350	G.E.	MPC	250	450
1—335	Whse.	MQ	250	300/900
1—300	G.E.	DMC	230	400/600
1—300	G.E.	MPC	230	275/550
1—250	G.E.	MPC	230	400/500
1—230	Al. Ch.		230	700
1—150	G.E.	MPC	230	250/450
8—150	Cr. Wh.	83H-TEFC	230	890
1—150	Cr. Wh.	CCM	230	300/1080
1—150	Cr. Wh.	CMC-65H	230	1150
2—125	G.E.	CC-1832	230	825
1—125	G.E.	CD-125	230	1150
1—115	Cr. Wh.	JHL	230	1200
4—101	Whse.	8K	230	435/880

40th year OF BUILDING A REPUTATION FOR QUALITY

BELYEA CO., INC.

Main Office and Shop

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Phone—Journal Square 2-3334

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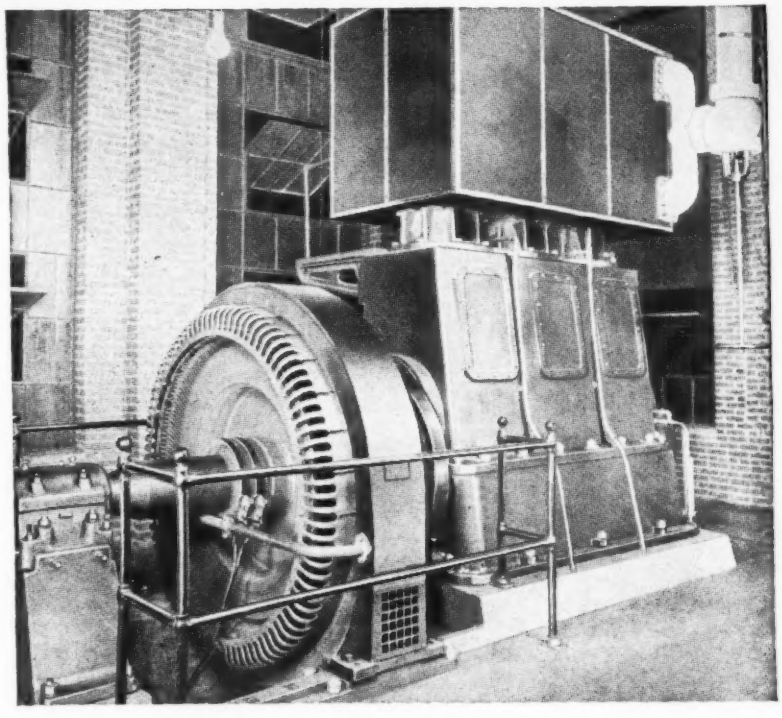
POWER PLANT MACHINERY - IMMEDIATE DELIVERY



960 I.H.P., 18" diameter x 16" stroke, 3 cylinder, 327 RPM Skinner Vertical Unaflow non-condensing engine, 150 lbs. pressure direct connected to a 750 KVA—600 KW, 80% P.F., 40° C rise, 3 phase, 60 cycle, 2300/600/480/240/208 volts 327 RPM Electric Machinery alternating current generator equipped with a 15 KW, 125 volt, 1450 RPM V-belt Electric Machinery Exciter, Switchboard panel with instruments and General Electric voltage regulator.

← ACTUAL PHOTOGRAPH

EXCELLENT CONDITION

COMPLETE INSTALLATION

TURBINE-GENERATOR UNITS
3 phase, 60 cycle

2500 KVA Westinghouse condensing 180 lbs. pressure, 2300 volts, 3600 RPM complete surface condenser, exciter.

1250 KVA G.E. condensing, 200 lbs. pressure, 2300 volt, 3600 RPM complete exciter, condenser, panel.

625 KVA G.E. non-condensing 150 lbs. pressure, 15 lbs. back, 2300 volts, 3600 RPM complete exciter, panel.

625 KVA Westinghouse automatic bleeder condensing, 250 lbs. pressure, 20 lbs. gauge, 480 volts, complete condenser.

500 KVA Westinghouse non-condensing 150 lbs. pressure, 10 lbs. back 240 volt, complete exciter and switchboard.

375 KVA G.E. condensing, 125 lbs. pressure, 2300 volt, 3600 RPM complete surface condenser and panel.

125 KVA Westinghouse non-condensing, 175 to 200 lbs. pressure, 0-10 lbs. back, 240 volts with exciter, panel.

125 KVA G.E. non-condensing, 175 to 200 lbs. pressure, 10 lbs. gauge back, 2300 volts, 3600 RPM complete.

120 KVA G.E.-Moore non-condensing 250 lbs. pressure, 7 lbs. gauge back, 240 volts, complete with switchboard.

100 KVA Westinghouse non-condensing, 125 to 150 lbs. pressure, 10 lbs. gauge back 2400/600 volts, 3600 RPM.

ENGINE-GENERATOR UNITS
ALTERNATING CURRENT—3 phase, 60 cycle

750 KVA G.E. 2300 volts 150 RPM generator direct connected 28"x32" Chuse Uniflow engine.

500 KVA Westinghouse 600 volt, 514 RPM Generator.

375 KVA G.E. 2300/480 volt, 180 RPM Generator direct connected to 21"x24" Chuse non-releasing Engine.

250 KVA (2) G.E. 2300/440/240 volts, 200 RPM generators each direct connected to 21" x 22" Skinner Universal non-condensing engine.

225 KVA E.M. 2300 volts, 200 RPM generator direct connected to 19"x24" Chuse Unaflow poppet valve engine.

187 KVA G.E. 2300 volt, 225 RPM Generator direct connected to 15"x19" Chuse non-releasing Engine.

180 KVA G.E. 240/440 or 550 volts, 200 RPM generator direct connected to 18"x21" Chuse non-releasing Corliss engine.

ENGINE-GENERATOR UNITS
DIRECT CURRENT

400 KW Maximum, Crocker Wheeler 125 volt, 300 RPM Generator direct connected to Skinner Unaflow Engine.

200 KW Burke 3-wire, 250 volt, 360 RPM generator direct connected Ames 4 cylinder vertical Unaflow non-condensing engine, 150 lbs. pressure complete switchboard.

200 KW G.E. 125 volt, 200 RPM generator direct connected Skinner Unaflow engine.

75 KW Allis Chalmers-Terry, 125 volts, 2480 RPM 150 lbs. pressure non-condensing turbine generator unit.

60 KW *New* Westinghouse 120 volt Marine type turbine generator units (3).

35 KW G.E. 125 volts, turbine-generator unit.

MOTOR GENERATOR SETS

1500 KW Allis-Chalmers 550/600 volts, 300 RPM direct current generator direct connected 2190 HP, 3 phase, 60 cycle, 4000/6600 volts synchronous motor.

500 KW Allis 250 volt, 1200 RPM direct current Generator direct connected to 3 phase, 60 cycle, 4000 volts Synchronous Motor.

500 KW Allis 250 Volt, 720 RPM direct current Generator direct connected 3 phase, 60 cycle, 2300 volt Synchronous Motor.

300 KW Allis 250 volt, 600 RPM direct connected 3 phase, 60 cycle, 4000/2300 volts Synchronous Motor.

62½ KVA G.E. 3 phase 60 cycle, 2300 volts, 1200 RPM alternator direct connected 75 HP, 115 volts direct current motor.

50 KW Westinghouse, 125 volt, direct current generator direct connected 75 HP, 3 phase, 60 cycle, 2300 volt motor.

Utilities Electrical Machinery Corporation

600 NATIONAL CITY BANK BLDG.
CLEVELAND 14, OHIO

WIRE OR PHONE
LONG DISTANCE 422

Reliably Rebuilt—YEAR Guarantee

A. C. Motors Generators

Squirrel Cage Motors

H.P.	Make	Type	Speed
300	West.	CS-8758	1700
150	Al. Ch.		720
147	West.	25 cy.	715
125	Cent.		1150
125	El. Prod.	B.B.	1150
125	G.E.	TEFC	1200
100(3)	G.E.	XP	900
100	G.E.	TEFC	900
100	G.E.		1200
100	Al. Ch.		680
75	G.E.	KF	3600
75	Al. Ch.		1800
75	G.E.	IK	1800
75	G.E.	KT-347	1200
50	Master	PA-405	1760
50	G.E.	KF-504	1150
50	Ideal	A	1150
50	G.E.	Class 2G	1200
50	West.	XP	900
40	G.E.	XP	1800
40	G.E.	XP	900
30	West.	CS-445	875
25	West. (2)	3S-364	3450
25	G.E.	XP	1200

Slipring Motors

600	Cr. Wh.		514
150	G.E. (2)	IM	600
100	Al. Ch.		695
100	Wagner	25 cy.	480
75	G.E. (2)	IM	690
60	G.E.	TEFC	720
50	Al. Ch.	ARY	600
50	G.E. (2)		514
40	G.E.	IM	1200
40	G.E.	MT-352	600
30	West. (2)	CI	900
30	G.E.	MT-541	720

Synchronous Motors

600	G.E.	900
150	Cr. Wh.	900
50	G.E.	1200

Generators

KW	Make	Speed
150	G.E.	600
100	West.	600

D.C. to A.C. Gen.

Size	Make	D.C.	A.C.
25	Star	115	120
25	Ideal	115	440
25	El. Mchy.	230	440
7½	Hertner	115	440
5	El. Spec.	110	110

D. C. Motors

230 V. Variable Speed

H.P.	Make	Type	Speed
150/200	West.	SK	400/1200
100	Rel.	1050T	400/1000
75	Cr. Wh.	CMC	375/750
60	G.E.	CI	480/1100
50	West	SK	500/1500
40	G.E.	CD	500/1500
35	G.E.	CRF	500/1500
25	G.E. (3)	RF12	500/1500
25	West.	SK140	400/1200
20	G.E. (2)	RF12½	400/1200
15	West.	SK93	600/1200
15	E.D.	10S	500/1500
15	West.	SK	250/1500
10	G.E.	RF10	600/1800
10	West.	SK	600/1200
10	G.E.	RF	400/1600
10	G.E.	RF	400/1200

230 V.

350	Al. Ch.		500
100	G.E.	CDP	1750
100	West.	SK163	1150
60	West.	SK160	680
50	West.	SK133	1300
50	Diehl	K10	850
50	West.	SK	750
40	G.E.	RC	1750
40	G.E.	RC	1075
40	G.E. (2)	DLC	1050
35	West.	SK	1150
30	G.E.	RC	1100
30	West.	SK	975
25	Rel.	92T	1150
25	West (4)	SK113	880
25	E.D.	10S	800
20	West.	SK60	1750
20	West.	SK83	1750
20	G.E.	CD	1200
20	Star (2)	SHB30	29

115 V.

25	Star	SQ15L	2400
25	G.E.	CDM85	1800
25	G.E.	CDM95	1200
20	G.E.	CD83	1750
20	West.	SK110L	750
10	L.A.	ONA284	3500

D. C. Generators

600 V.

KW	Make	Speed
200	Cr. Wh.	900
30	Burke	1750
30	E.D.	1150

250 V.

KW	Make	Speed
330	Elliot	1200
300 (2)	G.E.	1200
150	West.	900
150	West.	1180
150	G.E.	600
50	G.E.	1200
40 (2)	G.E.	1750
30 (3)	G.E.	1750
30	Cont.	1200
25	G.E.	1200
15	G.E.	1750
10	Star	1750
7½	West.	1200
5	West.	1750

125 V.

Kw	Make	Speed
250	G.E.	720
100 (2)	West.	900
100	G.E.	1200
50	Sturt.	2800
40	Cent.	1450
20	Delco	1200
15	G.E.	1150
10	Rogers	1450
7½	West.	1200
5	G.E.	1750

Low Voltage

Amps.	Make	Voltage
5000	Col.	6/12
2000	H.V.W.	6/12
1000	Col.	6/12
1000	H.V.W.	12/24
750	Star	15
1000	G.E.	15
600	Rel.	24
800	G.E.	33
1600	G.E.	30
800	G.E.	50
1200	G.E.	32
800	G.E.	30
100	G.E.	75
160	Cent.	75
1500	West	90

Miscellaneous

Pyrometers

40—Leeds & Northrup Model C-S & R.

D.C. Starters

150—230 V. Cutler-Hammer, D.C. automatic, 5 H.P. to 75 H.P.
100—230 V. Cutler-Hammer, manual, 1 H.P. to 3 H.P.
250—5 H. P. 115 V. Cutler-Hammer, magnetic.
75—1½ H.P. 230 V. General Electric, compound.
40—7½ H.P. 230 V. Cutler-Hammer reversing magnetic.

A.C. Starters

1—250—H.P. 4150 V.
1—150/200 H.P. G.E. Red, Volt. 440 V. Synchronous Starter.
40—Magnetic multi-speed A.C.
40—50 H.P. Cuter-Hammer up to 25 H.P. 440 V.
300—25 H.P. Ward-Leonard, 440 V.
1100—7½ H.P. Cutler-Hammer, 440 V.

Air Compressors

10x6 Gardner, 30 lbs.
12½x12 American, 125 lbs.

Pumps

LeCourtney—5 stage, 675 GPM, 1100 ft. head.

M.D. Blowers

50—1200 CFM—American, 3" static.
100—3000 CFM—U.S., 3" static.
75—200 CFM—Bayley, 2" static.
2—7½ H.P. Spencer.

230 V. D.C. Monorail Hoist

17—4000# Shepard
1—4000# Cleveland
1—3000# Shepard
1—3000# Cleveland
2—2000# Harnishfeger
2—2000# Shepard

A.C. Starters

8—½ to 20 KVA.

Meters

20—Weston Portable—A.C. and D.C. Model 155.

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South Western Representative
HOUSTON, TEXAS, 1400 Carr St., Phone: Charter 4-6558

Pennsylvania Office:
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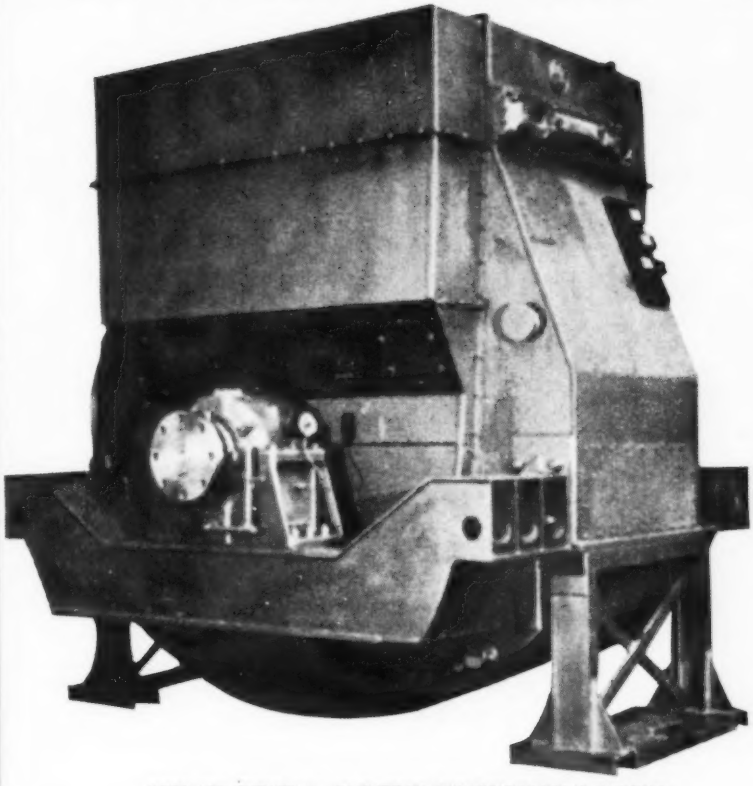
Phone: Reading 2-6866

POWER PLANT MACHINERY



3500 HP GENERAL ELECTRIC SYNCHRONOUS MOTOR

TOTALLY ENCLOSED SYNCHRONOUS MOTORS

6—3500 HP Unity P. F. General Electric synchronous motors, type TSM, form HL, 3 phase, 60 cycle, 11000/6600/-4150/2300/440 volts, 257 RPM. Equipped with Griscom-Russell surface air coolers and couplings.
New 1943—Excellent condition.

PACKAGE TYPE BOILERS

6—60,000# steam per hour Foster Wheeler boilers, 435# pressure, 750 deg. TT, equipped with water walls, superheaters, economizers, soot blowers, and Todd oil burners.

New 1943—Excellent condition.

CONDENSING TURBO UNITS
3 phase 60 cycle

3125 KVA Wstgh. 600 volts, 250# steam
2250 KVA G. E. 480 v., 250/400# steam
1875 KVA (2) G. E. 2300/600 volts, 225# steam
1875 KVA Allis 480 volts, 175# steam
1563 KVA Allis 2400 volts, 200# steam
1250 KVA (2) G. E. 2400/600 v., 250#
937 KVA G. E. 2300 volts, 150# steam
937 KVA Allis 480 volts, 175# steam
625 KVA (2) G. E. 2300 v., 200# steam
375 KVA (4) G. E. 480 v., 400# steam

NONCONDENSING TURBO UNITS
3 phase 60 cycle

2500 KVA G. E. 480 volts, 150# steam, 15# exhaust
1563 KVA Allis 2300 volts, 200# steam, 15# exhaust
1250 KVA Wstgh. 2400 volts, 300# steam, 10# exhaust
1250 KVA (2) DeLaval 4150 volts, 250# steam, 70# exhaust
625 KVA G. E. 2300 volts, 200# steam, 7# exhaust
375 KVA G. E. 240 volts, 150# steam, 10# exhaust
250 KVA (4) G. E. 400 volts, 400# steam, 10# exhaust

EXTRACTION TURBO UNITS
3 phase 60 cycle

3750 KVA Wstgh. 2400 volts, 150# steam, 10# extraction
1563 KVA Wstgh. 2400 volts, 175# steam, 15# extraction
1250 KVA Allis 480 volts, 300# steam, 35# extraction
940 KVA Wstgh. 600 volts, 150# steam, 20# extraction
875 KVA Moore 2300 volts, 300# steam, 100# extraction
625 KVA Wstgh. 480 volts, 250# steam, 25# extraction

UNIFLOW UNITS
3 phase 60 cycle

625 KVA Skinner, 2300 volts, 140# steam, 5# exhaust
375 KVA Skinner, 2300 volts, 125# steam, 5# exhaust
312 KVA Skinner, 480 volts, 165# steam, 5# exhaust
312 KVA Nordberg, 240 volts, 150# steam, 5# exhaust
280 KVA (2) Skinner, 2300 volts, 150# steam, 5# exhaust
250 KVA Skinner, 480 volts, 165# steam, 5# exhaust
208 KVA Skinner, 240 volts, 125# steam, 5# exhaust

DIESEL UNITS
3 phase 60 cycle

300 KVA McIntosh-Seymour, 2300 volts
250 KVA (3) McIntosh-Seymour, 2300 volts
187 KVA (3) Fairbanks Morse, 2400 volts

GENERATORS
3 phase 60 cycle

2500 KVA (4) G. E. 2300/480 volts, 257 RPM
1150 KVA Wstgh. 600 volts, 400 RPM
750 KVA (2) G. E. 600 volts, 300 RPM

MOTOR GENERATOR SETS
3 phase 60 cycle

300 KW G. E. 250 v. D. C., 440 v. A. C.
200 KW G. E. 250 v. D. C., 440 v. A. C.
200 KW C. W. 125 v. D.C., 2300 v. A.C.

ROTARY CONVERTERS
3 phase 60 cycle

3500 KW G. E. 225/285 v. D. C., 13800 v. A. C.
1500 KW (2) Wstgh. 270 v. D. C., 13800 v. A. C.

TRANSFORMERS
3 phase 60 cycle

2500 KVA Wstgh. 2400-480 volts
500 KVA (3) Allis Chalmers 2300/4160-460 volts
400 KVA (4) Wstgh. 13200-4600 volts

INTERNATIONAL POWER MACHINERY CO.

UNION COMMERCE BLDG. PHONE LONG DISTANCE 350 CLEVELAND 14, OHIO

GLOW ELECTRIC CO

SQUIRREL CAGE MOTORS

HP	RPM	Volts	Make
350	514	440	GE-I
250	600	2300	Triumph
223	3600	4150	GE-FR
125	340	220	A-C
100	514	220	A-C
100	450	220	A-C
75	720	2300	Wagner
75	360	220	GE-I
60	3600	2300	GE-KT
50	720	2300	Wtg.-CS
40	900	2300	Wtg.-CS
35	600	220	FT. Wayne
30	720	220	GE-HI
25	1200	2300	GE-I
25	900	220	GE-FTR
25	900	220	Wtg.-CS
25	720	220	Wagner
25	600	440	GE-I
20*	1800	220/440	F-Morse
20*	1200	2300	F-Morse
20	900	440	Wtg.-CCL
20	900	2300	Wtg.-CS
20*	1800	220/440	Master
15	3600	220	GE-KT
15	1800	220	Wtg.-CS

ENCLOSED SQUIRREL CAGE

HP	RPM	Volts	Make
125*	1200	440	GE-TEFC-BB
7½*	1800	dual	Wagner-TEFC-BB
7½*	1800	dual	Master-TEFC-BB
7½	1200	dual	GE-HI Slip-TEFC-BB
7½	1090	220/440	GE-KR, high slip
5*	1800	dual	Master-TEFC-BB
5	1800	220	Wagner TE-BB
5*	1200	dual	GE-TEFC-BB
3	3600	440	Wtg.-TE-BB
3	1800	dual	Delco-TEFC-BB
3	1200	dual	Rel.-TEFC-BB
2	1200	220	GE-TE-BB
2	900	220	Wagner-TE-BB
2	1800	dual	Delco-TEFC-BB
1½	900	dual	Delco-TEFC-BB
1½	1800	dual	L. Al.-TE-BB
1½	1200	dual	Ref-TEBB
1	3600	220	Haskins-TEFC
1	1800	dual	Master-TEFC-BB
1*	1800	dual	Delco-TE-BB
1*	1200	dual	Rel.-TE-BB
¾	3600	440	Delco-TE
¾	1800	dual	Wesche-TE-BB
¾	3600	220	Ohio-TE-BB
¾	1800	440	Wtg.-TE-BB
¾*	1800	dual	Delco-TE-BB
¾	1200	220	Cr.Wh.-TE
¾	3600	440	GE-TE
¾	1800	220	Delco-TE-BB
¾	1800	440	Delco-TE-BB
¾	1200	440	Wtg.-TE-BB

* New Motor

SLIP RING MOTORS

HP	RPM	Volts	Make
500	900	440	GE-3 Brg.
400	1200	2300	Al. Ch.
400	900	440	GE-IM
375	1800	2300	Al. Ch.
235	1800	220	GE-I
250	300	2300	Al. Ch.
200	514	440	Triumph-C
75	360	220	GE-I-M
60	1800	dual	Al. Ch.
60	900	2300	Burke
60	900	220	Wesche
50	900	2300	Ridgeway
50	900	440	Wagner
50	720	440	Al. Ch.
40	1200	220	Wtg.-CW
40	900	2300	Al. Ch.
40	900	220	Wtg.-HF
40	720	2300	Wtg.-HF
40	720	220	Al. Ch-ANY
40	600	2300	Al. Ch-ARY
40	600	220	Al. Ch.-ANY
40	450	220	Triumph-C
35	900	2300	Ridgeway
35	720	220	GE-I
30	1800	2300	Wtg.-CW
30	1200	2300	Lincoln
30	900	220	GE-MT
30	900	2300	Ridgeway
30	720	220	GE-I
30	600	220	F. Morse-BV
30	1200	440	Wagner
25	1200	2300	Al. Ch.-ANY
25	900	220	GE-MT
25	720	dual	Watson-KH
25	600	220	Watson-KH
20	1800	440	Al. Ch.
20	900	2300	GE-I
20	565	440	Wtg.-HF

VERTICAL MOTORS

HP	RPM	Volts	Make
200	1200	440	Al. Ch.-SR
150	1200	2300	GE-SR
150	1200	440	GE-Cage
125	1200	2300	Al. Ch.-Cage
100	1200	440	GE-Cage
75	1200	2200	GE-Cage
75	360	220	Ideal-Cage
60	1800	230 D.C.	GE
60	1200	440	Al. Ch.-Cage
50	1800	440	GE-Cage
50	1200	2200	Wtg.-Cage
50	600	440	Al. Ch.-Cage
40	1800	220	GE-Cage
40	1700	230 D.C.	GE
40	1200	440	Wtg.-SR
40	1200	220	GE-Cage
40	950	230 D.C.	Wtg.
35	1800	440	GE-Cage
35	1200	2300	Al. Ch.-Cage
35	450	440	GE-Cage
30	1200	dual	Wtg.-Cage
25*	1550	230 D.C.	GE
25	1200	2200	GE-Cage
25	850	230 D.C.	Wtg.
20	1200	440	Al. Ch.-Cage

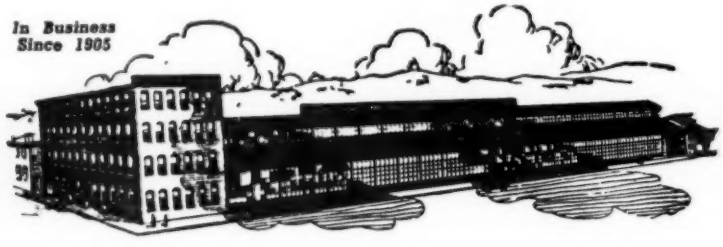
VERTICAL MOTORS—Cont'd

HP	RPM	Volts	Make
20	800	230 D.C.	GE
15*	1800	440	Al. Ch.-Cage
15	1750	110 D.C.	Wtg.
15	1150	230 D.C.	GE
15	600	440	Al. Ch.-Cage
12½	900	220	L. Al.-Cage
10	3400	230 D.C.	Wtg.
10	900	220	Wtg.-Cage
7½	1800	500 D.C.	Peerless
7½	900	440	Burke
7½	700	230 D.C.	GE-Cage
6	850	110 D.C.	Rel.
5	1400	230 D.C.	R. & M.
5	600	440	GE-Cage
4	1650	110 D.C.	Watson
3	1700	230 D.C.	Watson
3	1200	dual	Wtg.-Cage
3	900	440	Wtg.-Cage
3	600	dual	Wtg.-Cage
2	1800	230 D.C.	GE
2	1800	220	L. Al.-Cage
2	1180	230 D.C.	Wtg.
2	900	220	GE-Cage
1	1200	220	GE-Cage

SYNCHRONOUS MOTORS

HP	RPM	Volts	Make
710	720	13200/6600	GE-ATI
250	225	2200	GE
250	225	440	GE
200	225	2200	Wtg.
175	225	208	GE
160	600	440	GE
160	164	440	GE
120	225	220	E-M
115	164	208	GE
60	360	2200	GE
50	360	440	GE
30	900	440	Wagner
30	600	550	GE
30	450	dual	Wtg.
30	360	550	GE
30	327	220	E-M
25	1800	220	Wagner
25	450	220	E-M
25	300	220	Ideal
20	900	220	Wtg.
20	600	220	E-M
15	1800	220	Wagner
10	1800	220	Wagner
10	1200	220	Wagner
7½	1200	440	Wagner

In Business Since 1905



TRANSFORMERS

General Electric Spirakore Transformers, 167 KVA, 2400/4160Y volt primary, 120/240 volt secondary, 1 phase, 60 cycle, oil cooled, outdoor type. Alternative same except secondary 240 or 480 volt.

DIRECT CURRENT GENERATORS

KW	Volts	RPM	Manufacturer	Description
400	120/940	300	Westinghouse	Compound, Interpole Pedestal Bearings
200	250	375	Jantz & Leist	Compound Wound, Pedestal Bearings
175	250	450	Westinghouse	Compound Wound, Pedestal Bearings
80	125	500	Jantz & Leist	Compound Wound, Double Shaft Extension
80	125	400	Jantz & Leist	Compound Wound, Double Shaft Extension
30	250	300	Triumph	Compound Wound
22½	250	765	Westinghouse	Compound Wound

MOTOR GENERATOR SETS

KW	Volts	Generator Mfgr.	A. C. Motor
500	600	General Electric	710 HP, 1 P.F., 720 RPM, 13200/6600 Volts, General Electric, Synchronous
*300	250	General Electric	450 HP, 1200 RPM, General Electric, Synchronous
200	230/250	Crocker-Wheeler	300 HP, 1 P.F., 600 RPM, 2300 Volts, Allis-Chalmers, Synchronous
200	125	General Electric	300 HP, 900 RPM, General Electric, Synchronous
50	120/125	Burke	95 HP, 1200 RPM, Burke, Synchronous
40	250	Reliance	60 HP, 1800 RPM Century, Induction
25	125	General Electric	35 HP, 1200 RPM, General Electric, Induction

* These Motor Generator Sets are unused.

AC & DC MOTORS • GENERATORS • PUMPS
SYNCHRONOUS MOTORS • CONTROL EQUIPMENT
MOTOR GENERATOR SETS • ELECTRIC EQUIPMENT
STEAM ENGINE GEN. SETS • SLIP RING MOTORS

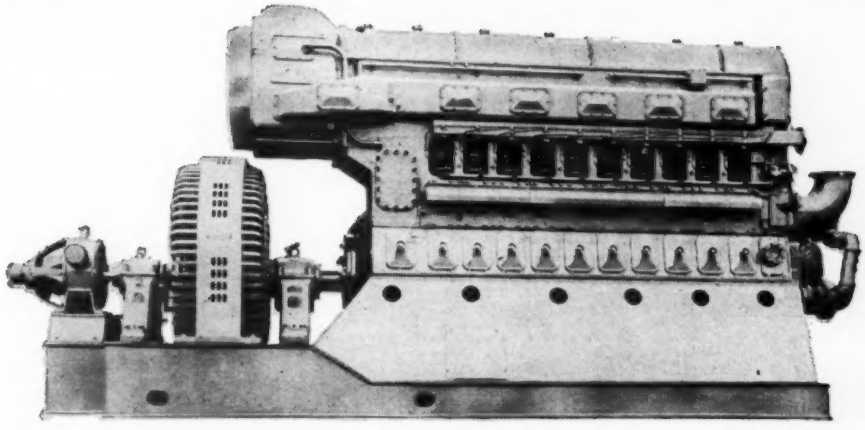
933-943 HARRIET ST.
PHONE MA. 3024
CINCINNATI 3, OHIO

DIESEL ELECTRIC POWER

FROM

AGSCO

A 1250 KVA
DIESEL
GENERATING UNIT



IMMEDIATE DELIVERY

50 AND 60 CYCLE OFFERINGS

ALTERNATING CURRENT HEAVY DUTY DIESEL GENERATORS

KVA	Make	HP	Model	RPM
1250	Fairbanks Morse	1600	38D8⅛	720
1250	Cooper Bessemer	1500	LS-8	327
1250	General Motors	1600	16-278A	720
1250	Nelseco	1500	6MI-53	300
1000	Fairbanks Morse	1200	38D8⅛	600
900	General Motors	1200	12-567	720
625	Superior	750	OS	327
400	Ingersoll Rand	460	S	600
375	De La Vergne	448	VO	400
300	Fairbanks Morse	360	Y	257
156	Fairbanks Morse	150	32E14	300
100	Buckeye	150	E	325 (BC)

DIRECT CURRENT DIESEL GENERATORS

KW	Make	HP	Model	RPM
1000	Fairbanks Morse	1600	38D8⅛	720
1000	General Motors	1600	16-278A	720
660	Cooper Bessemer	950	LS	327
300	Baldwin	450	VO	400
100	General Motors	150	3-268A	1200
100	Superior	150	GDB-8	1200

ALTERNATING CURRENT HIGH SPEED DIESEL GENERATORS

KVA	Make	HP	Model	RPM
250	General Motors	350	8-268A	1200
125	General Motors	150	3-268A	1200
94	General Motors	160	6045A	1800
62	Inter. Harvester	76	UD-18	1200
37	Inter. Harvester	45	UD-14	1200

Engineered AGSCO DIESEL POWER

A. G. SCHOONMAKER Company, Inc.

ESTABLISHED 1898

Diesel Engines • Power Machinery

50 CHURCH STREET, NEW YORK 7, N. Y. PHONE DIgby 9-4350

NEW *Never Installed*

SURFACE CONDENSERS

9300-Sq. Ft. to 100-Sq. Ft., Surface Type in Stock NEW
ALSO NEW CONDENSER AUXILIARIES
Circulating and Condensate Pumps, Air Evactors, Etc., Etc.

WE CAN SAVE YOU: 33⅓% TO 75%

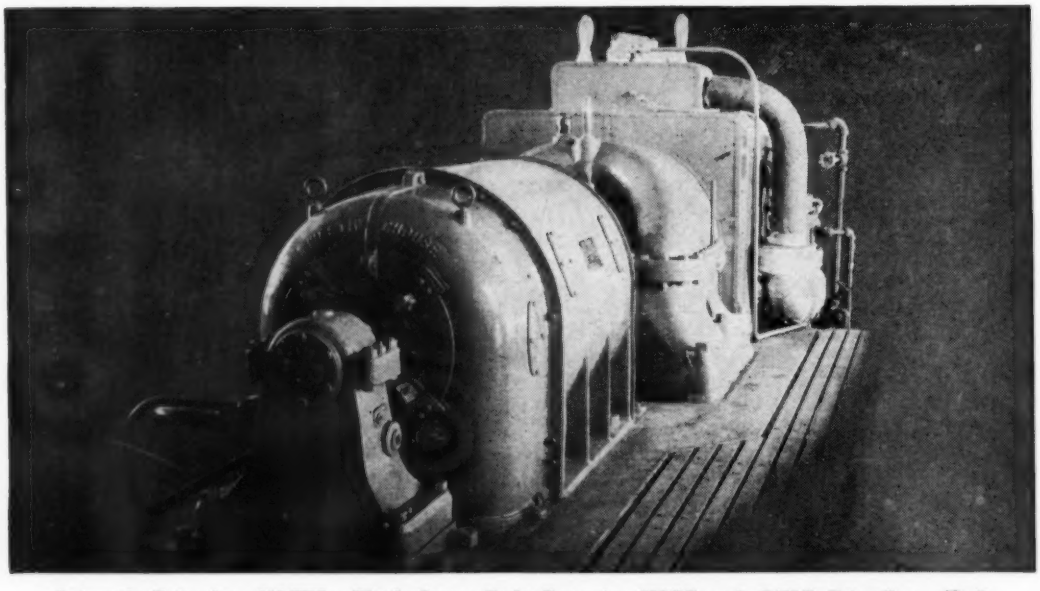
Our Recent Outright Purchase of Many Thousands of Dollars of New Equipment Includes Nearly Every Item Used in Power Plant Operation

SPECIALS

12—100-KW. Diesel Engine Generator Sets (NEW)
2—450# psi. 720 FTT., 2250-KW. Turbine-Generators
4—400-HP, Enterprise Diesel Engines: NEW
6—GM. 150-HP. Model 3-268, Diesel-Gen. Sets (NEW)
1—1250 KVA, 300#-psi. 20# BP, West. Turbo-Generator

TURBO-GENERATORS

IMMEDIATE DELIVERY



Automatic Extraction, 625-KVA., Westinghouse Turbo-Generator 250#G. psi. 5/25# Extraction. Shaft Exciter Switchboard, Etc. Condition, Excellent

USED TURBO-GENERATORS: Partial List Only of Our Stock

5000-KVA. G.E. 200#, 100-Deg., 2300-V.
3750-KVA. G.E. 200#, 2300-V., Condensing
2500-KVA. West., 200#, 2300-V., (1-GE.)
1865-KVA. G.E., Cond., 200#, 2300-V.
1250-KVA. Allis-C. Non-Cond. 160#, 25-Back, 2300-V.
937-KVA. Allis-Chalmers Cond., 220#, 480-V.
625-KVA. West., Aut. Extr., 250#, 25#-Back, 480-V.
625-KVA. G.E., Non-Cond., 200#, 25#-Back, 2300-V.
500-KW., Several Good Units Available

Bulletins Nos. 205, 208, 249 — Free For the Asking: Write Today

CHARLES WEAVER & COMPANY

4045 Penobscot Buuilding *ENGINEERS* Detroit 26, Michigan

Motors

. . . always a wide selection . . . always unusual values

Listed below a few of the motors available in a hurry from Wente

SQUIRREL CAGE

3 Phase, 60 Cycle, 220 or 440 Volt

(Other voltage as noted)

Qu	HP	Make	Type	Speed
1	250	G.E.	KF Vert.	3600
3	200	G.E.	K-566, 2300 Volt	720
1	250	F.-M.	HF. 2200 Volt	720
1	150	Al. Ch.		1750
2	125	Ch.Wh.	126Q	430
1	120	G.E.	FT	3600
1	60	Reliance	AA	900
2	50	R.&M.	L	1200
1	50	Al. Ch.	AN	900
1	50	G.E.	1 2200 Volt	900
1	50	G.E.	I	720
1	50	Wagner	BM	495
1	50	Al. Ch.		490
2	35	Al. Ch.	2 phase	900
1	35	Al. Ch.		900
1	30/30	West.	CS TEFCBB 1800/900	
1	30	F.M.	QZK Open BB	1200
1	30	Cr. Wh.		900
2	30	Al. Ch.	AS 2 Phase	900
1	30	Century	AS	720
1	25	Howell		1200
1	25	F.M.	QZK B.B. New	1200
1	25	Wagner	BP	1200
1	25	Burke	EM3	900
1	25	Lincoln		900
1	25	Al. Ch.	AN	720
1	25	G.E.	M10	720
2	20	U.S.	SC SP B.B.	1800
2	20	F.M.	QZK B.V. New	1800
1	20	West.	CS	1800
1	20	Howell	N. Vert. B.B. New	1200
1	20	F.M.	KRV	1200
1	20	Cr. Wh.		900
1	20	G.E.	I-K 2200 Volt	900
1	20	Cleve.	M	900
1	20	Al. Ch.		900
1	18	West.	MS (Elev.)	720
1	15	F.M.	HLSV	3600
4	15	F.M.	QZK B.B. New	1800
1	10	Al. Ch.		1800
1	10	Imperial	EH B.B.	1200
5	7½	G.E.	KT	1800
1	7½	West.	CS	1800
3	7½	Wagner	11VRW	1800
3	7½	G.E.	KT	1200
20	5	Imperial	E (New)	1200

Approx. 200 New motors from 2 HP—30 HP.

SLIP RING & SYNCHRONOUS

3 Phase, 60 Cycle, 220 or 440 Volt

(Other voltage as noted)

Qu	HP	Make	Type	Speed
1	443	El. M.	Syn.	900
1	300	G.E.	ATISYN	1800
1	300	El. M.	2300 Volt	360
1	100KW	G.E.	ATS Syn.	900
1	100	G.E.	I-16 2200 Volt	450
1	75	F. M.	BV 2200 Volt	1800
1	75	West.	(New) Syn.	1200
1	60	Ideal	AVX	1200
1	50	G.E.	I 25 Cycle	700
1	50	Al. Ch.		720
1	50	Ideal	AV 2200 Volt	600
1	40	G.E.	MT	1200
1	40	Al. Ch.		1200
1	40	G.E.	MT	900
2	40	West.	CW 2200 Volt	900
2	40	West.	CW	900
2	40	Al. Ch.		900
1	40	West.	CI	730
1	40	Burke	EMV7	1150/550
1	35	Al. Ch.		720
1	35	G.E.	I-12	600
1	30	Al. Ch.	2200 Volt	720
1	25	Cr. Wh.		1200
1	25	West.	CW	720
1	25	West.	MW	720
1	25	G.E.	MT Tot. Encl.	600
1	25	G.E.	MT	400

DC—230 Volt

Qu	HP	Make	Type	Speed
1	130	Cr. Wh.	CMC 550 Volt	1200
1	100	G.E.	CD	1200
1	100	West.	SK	1800
1	100	G.E.	RC38	600
1	100	G.E.	PC8 440 Volt	400
4	100	Cr. Wh.	CMC 225/550	
1	75	Diehl	K11	700
1	60	West.	SK 115 Volt (Vert.)	1200
3	50	West.	SK	1200
1	40	Rel.	440 Volt B.B. Vert.	1800
1	40	Rel.	440 Volt B.B. (Vert.)	1200/1800
1	25/40	Cr. Wh.	CMC 440 Volt (Vert.)	1200/1800
1	40	Rel.	B. P.	400/1500
2	40	West.	SK	1200
1	40	G.E.	RC	1200
7	40	West.		775
1	35	G.E.	OMTEBB	1300
1	35	West.	SK	1200
1	35	Al. Ch.		1200
1	35	G.E.	DLC	700
2	30	El. Dy.	158	625/1250
5	30	Rel.	92TF	1800
1	30	Rel.	131 440 Volt (Vert.)	1200
1	30	G.E.	RC	1200
1	30 KW	Al. Ch.	110 Volt	925
1	27½	G.E.	CVC116	1800
1	25	Cr. Wh.	CM 110 Volt	900/1200
1	25	Al. Ch.	E120	500/1500
1	25	Rel.	25P	250/1000
1	25	G.E.	RF	300/900
1	25	F.M.	IRC	400/800
6	25	West.	SK	1200
7	25	West.	SK	850
2	20	Rel.	131T	1060/2000
2	20	West.	SK	750/1500
1	20	Diehl	K9	500/1000
1	20	G.E.	CD	400/1600
1	20	G.E.	RF	250/1000
1	20	Lincoln	FKW B.B.	1800
6	20	Cr. Wh.	CMC Enclosed	1800
1	20	Cr. Wh.	CMCTEBB (Exp.)	1200
1½	20	Rel.	92T	1200
2	20	West.	SK	1200
1	20½	West.	SK	900
1	20	G.E.	RC	900
7	20	West.	SK	750
1	20	West.	SK	500
1	15	West.	SK83	1800
1	15	West.	SK113 Encl.	1800
1	15	F.M.	D B. B.	1150
6	15	Rel.	66T	1150
2	15	Cr. Wh.	CCM	1150
1	15	Cr. Wh.	CCM Tot. Encl.	1500
1	15	West.	SK83	1150
2	15	West.	SK80L	1150
1	15	G.E.	CD	1150
1	15	West.	SK90	850
1	15	West.	KS Crane	630
8	15	Rel.	92F	850/1700
2	15	G.E.	CO Crane	650/2700
1	15	Rel.	131T 115v.	600/1500
2	15	West.	SK	600/1200
1	15	Rel.	76T	400/1600
1	15	G.E.	RF11	400/1200
1	12½	West.	SK	750/1500
1	12	G.E.	RF	575/1725
1	10	West.	SK7	850/1700
2	10	G.E.	RF10	600/1800
1	10	West.	SK90	600/1800
7	10	West.	SK80L	500/1500
20	10	Al. Ch.		500/1000
1	10	Rel.	92TF	400/1000
1	10	West.	SK	250/1000
6	10	Cr. Wh.	CM TEBB	1800
1	10	Century	R304	1800
15	10	West.	SK	1150
2	10	West.	SK 115 Volt	1150
3	10	Rel.	46TF	1150
1	10	G.E.	RC9	1150
2	10	Rel.	66TF	850
2	10	G.E.	RC	850
3	10	West.	SK70	850
1	10	G.E.	RC29 550 Volt	850
1	10	Colonial		950
14	7½	West.	SK33	1750
4	7½	West.	SK60	850
20	5	West. & Gen. Elec.		1720
20	5	West. & Reliance		1150
35	5	West.	SK 43	850

Hundreds of other DC motors not listed

27—New vertical, T.E.F.C.B.B., 3 Ph., 60 Cy. 220/440 volt as follows:
1—Fairbanks-Morse, 3 HP. ty. QZCU, Fr. 254, 1200 RPM Exp.
2—General Electric 3 HP. ty. K Fr. 254 1200 RPM
8—General Electric, 7½ HP. ty. Fr. 324, 1200 RPM
8—Delco, 7½ HP. type C, Fr. 324, 1200 RPM
1—Howell, 7½ HP. type KV. Fr. 284, 1800 RPM
5—General Electric, 15 HP. type K. Fr. 365, 1200 RPM
2—Howell, 15 HP. type KV. Fr. 365, 1200 RPM

1—New General Electric 250 HP. type KF, Frame 549-A, 440 volt, 3 phase, 60 cycle, 3600 RPM vert., direct connected to Bingham type 2, 22 stage, double case, 3600 RPM, 3820 head, 175 GPM

1—New Allis Chalmers 200 HP. type ARZ, 2300 Volt, 3 phase, 60 cycle, 3600 RPM, totally enclosed fan cooled, ball bearing.

1—150 KW Westinghouse synchronous M-G set, 275 volt DC, 4400 volt AC, 3 phase, 60 cycle, 900 RPM, AC control & DC panel
1—150 KW General Electric M-G set 250/275 volt DC, 440 volt AC, 3 phase, 60 cycle, 900 RPM
1—100 KW Ridgeway synchronous M-G set, 250 volt DC, 2300 volt AC, 3 phase, 60 cycle, 1200 RPM with AC control & DC panel
1—200 KW Burke synchronous M-G set, 250 volt DC, 440 volt AC, 3 phase, 60 cycle, 900 RPM with AC control & DC panel
1—30 KW Westinghouse M-G set, 125 volt DC, 2300 volt AC, 3 phase, 60 cycle, 900 RPM with AC control & DC panel

6—Practically new 40 KW Reliance & General Electric variable voltage M-G sets, 250 volt DC, 220/440 volt AC, 3 phase, 60 cycle, 1800 RPM, complete with exciters all control and drive motors. All motors ball bearing, enclosed M-G set, exciters and control mounted in fan cooled enclosure. Drive motor G.E. type CD, frame 144i, 40 HP. 230 volt 400/1600 RPM, enclosed, ball bearing, 50° Cont 250 RPM, 1 hr. 50°

The Wente Electric Co.

Hamilton — *Rebuilt Motors and Generators Since 1906* — **Ohio**

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FOR MORE THAN 40 YEARS
THE MARK OF DEPENDABLE ELECTRICAL EQUIPMENT

MOTORS . . . GENERATORS . . . M-G SETS

PUMPS . . . FANS . . . BLOWERS . . . SPEED REDUCERS

PARTIAL LISTINGS—WRITE, WIRE OR PHONE YOUR REQUIREMENTS

M-G SETS

KW	Mfr.	Input V.	Output V
500	Allis Ch.*	2300 AC	250 DC
300	Gen. Elec.*	220/440 AC	230 DC
200	Gen. Elec.*	2200 AC	125 DC
150	Gen. Elec.	220/440 AC	125 DC
105	Century b.b.	220/440 AC	70 DC
80	El. Prod.*	220/440 AC	125/250 DC
50	Cr. Wheeler	220/440 AC	250 DC
37½	Whse.	230 DC	3 ph. 240 AC
35	Gen. Elec.	220/440 AC	48 DC
30	Marble Card	220/440 AC	60 DC
30	Elec. Prod.*	220/440 AC	50 DC
25	G.E. NEW	220/440 AC	125 DC
9	H.V.W. 1500 amp.	220/440 AC	6/12 DC

*Synch. motor drive.

D. C. MOTORS

H.P	Mfr.	Type	Volts	Speed
100/150	G.E. dynamom.	TLC	25	1000/3500
80/125	Gen. Elec.	C100	230	500/1000
75	Whse.	813L	115	575
75	Gen. Elec.	BRC	115	1150
65	Gen. Elec.	C	230	375/750
60	Diehl dynamom.	R10	250	500/2000
60	G.E. bb (2)	CDM103	230	1750
50	Cr. Wheeler (2)	50H	230	700
50	Gen. Elec.	CL	230	600
40	Whse.	SK	230	750
40	Reliance (2)	310T	230	625/1200
40	Gen. Elec.	RC31	230	1750
35/50	Gen. Elec.	CD123	230	575/1150
30	Whse.	8-7	115	900
25	Sprague dyna.	LC	230	750/2000
25	Chand'son (4)	C13	115	850
25	Roth	RS	230	1750
25	G.E. bb NEW	CDM93	115	1150
20	G.E. bb NEW	CDM83	115	1750
20	Gen. Elec.	RC11	115	1150
20	Reliance	T	230	850
20	Gen. Elec.	LC	230	575
20	Gen Elec.	DLC	230	500/1500
15	Gen. Elec.	RC	115	1150
15	Roth	85RS	230	1750
15	G.E. bb NEW (2)	CDM67	115	1750
15	Gen. Elec.	RC10	230	1150
15	Whse. (5)	SK90	230	825
15	Gen. Elec.	CD95	230	550/1650

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
300	G.E. 1 brg.	MPC	125/170	1150
105	Century b.b.	1500a.	70	1200
100	G.E.	TLC	250	1150
80	G.E.	C100	250	600
75	Whse.	8	125	600
50	Gen. Elec.	CL	250	750
50	Cr. Wheeler	CCD	250	850
24	Whse.	SK	600	850
25	G.E. NEW b.b.	CD93	125	1450
20	Allis Ch.		125	475
12	Engberg b.b.	MR	250	1150
15	Gen. Elec.	RC	125	1200

SPECIAL—FREQUENCY CHANGER
125 KW G.E. ITT565 changer 25/60 cycle 440V. coupled to 100 HP. KT559 motor 3/25/440V. 750 RPM.

EXPLOSION PROOF MOTORS—NEW

2—3 HP 1200 RPM	1—10 HP 900 RPM
2—7½ HP 1800 RPM	1—15 HP 1800 RPM
1—7½ HP 900 RPM	2—20 HP 1800 RPM

A. C. GENERATORS

KVA	Mfr.	Type	Volts	Speed
625	Gen. Elec.	ATB	2300	450
500	Allis Ch.	3 brg.	240/480	360
250	Whse.	G	2300	600
150	Allis Ch.	B	2300	900
125	Gen. Elec.	ATB	240/480	300
100	Cr. Wheeler		2300	900
75	Triumph	A15L	240/480	900
60	El. Machy.		240/480	900
50	Cont. b.b.	S107	120/208	1200
25	Whse. b.b. (3)	1 phase	120	900
12½	Whse. b.b. NEW		240	1200

A. C. MOTORS—SLIP RING
3 Phase 60 Cycle 220 or 440 Volts

Qu.	H.P.	Mfr.	Type	Speed
1—	400	G.E. 3 brg.	I-P	450
1—	300	G.E. 2200V.	I-M	1800
1—	300	Gen. Elec.	MT365	1200
1—	200	Gen. Elec.	IM-E13B	1800
1—	200	Whse. 3 brg.	HF	600
1—	200	G.E. 2200V.	IM-15A	720
2—	150	G.E. int.	ITC5015	720
1—	100	Whse.	CW761C	1800
2—	100	Gen. Elec.	IM-15	720
1—	75	Gen. Elec.	IM-14	600
1—	75	Gen. Elec.	MT337	1800
1—	50	Fair. Morse	BV	720
1—	50	Gen. Elec. int.	ITC	600
1—	50	Whse. int.	CI	600
2—	40	Gen. Elec.	MT336	900
1—	40	Allis Ch.	ANY	450
1—	37	G.E. int.	ITC	600
1—	35	Lancashire	b.b.	1800
1—	30	Gen. Elec.	OMT336	1200
1—	30	Gen. Elec.	MT346	600
2—	25	Gen. Elec.	I-M	1200
1—	25	Triumph	SR	1200
1—	25	Gen. Elec.	I-M	600
1—	20	P&H b.b. int.	WT8	1200
1—	15	Watson	KHV	720
1—	15	P&H b.b. int.	W7	1200

A. C. MOTORS—25 CYCLE

H.P.	Mfr.	Type	Volts	Speed
150	Whse.	C	440	500
150	Whse.	HF	440	500
50	G.E. int.	MTC5337	440	750
50	Allis Ch.	ANY	440	1500
25	Howell	SR	440	750

1000 NEW MOTORS IN STOCK
A.C. 1 ph. & 3 ph.—Fract. H.P. up to 60 H.P.—All speeds, open & enclosed—standard makes—quantity discount.

SPECIAL—500 KW M-G SET
Allis Chalmers 725 HP synch. motor 3/60/2300 V. on base coupled to 500 KW gen. DC 250 V 900 RPM with AC & DC panels. NEW in 1943, A-1 condition now.

A. C. MOTORS—SYNCHRONOUS

H.P.	Mfr.	Type	Volts	Speed
667	Gen. Elec.	ATI	2200	450
300	El. Machy.	late	2200	360
275	Whse.	G	2200	900
200	El. Machy.	late	2200/4000	600
150	Gen. Elec.	ATI	220/440	300
125	G.E. splprf.	TS955	220/440	1200
110	El. Machy.	BRKT	220/440	1200
75	E. Prod. b.b.	.8PF	2200	1200
75	El. Machy.	BRKT	550	900

A. C. MOTORS—SQUIRREL CAGE
3 Phase 60 Cycle 220 or 440 Volts

Qu.	H.P.	Mfr.	Type	Speed
1—	250	G.E. 2200V.	I-K	600
1—	250	Gen. Elec.	KT559	1800
2—	200	G.E 2200V.	KTP559	1200
1—	200	Gen. Elec.	I-K	514
1—	150	Allis Ch. b.b.	AR	720
1—	150	Reliance b.b. encl.	AA	900
2—	150	Fair. Morse	B	600
2—	125	Allis Ch. b.b.	AR	450
1—	125	Cont. 2200V. b.b.	SC	1800
1—	125	Northwn.	H	1800
1—	125	Cr. Wheeler	125Q	900
1—	100	Whse. vertical	CS	1200
1—	75	Gen. Elec.	KT329Y	3600
1—	75	Gen. Elec.	KT352	900
1—	75	Gen. El.	I-K	720
1—	60	Allis Ch. 4000/2200V.	AR623	1800
1—	60	Howell b.b.	SC416	1800
2—	60	G.E. NEW b.b.	K444S	1800
4—	60	Gen. Elec.	K505	1200
1—	60	Gen. Elec.	I-K	600
1—	50	G.E. 2 phase	I-Q	900
2—	50	G.E. NEW b.b. HT	KG405	1800
1—	50	Whse. spl. b.b.	CS445	1800
1—	50	G.E. NEW hitorq	KG445	1200
2—	50	Gen. Elec.	K505	900
1—	50	Gen. Elec.	KT342	900
2—	50	Whse. vertical	CS766	900
1—	40	Howell b.b.	SC	1800
1—	40	Al. Ch. 3 speed	ARX	900/600/450
2—	40	G.E. NEW b.b.	K404	1800
1—	40	Gen. Elec.	I-K	1200
6—	40	Gen. Elec.	KT336	900
2—	35	Gen. Elec.	I-K	720
2—	35	Gen Elec.	I-K	900
2—	30	Howell b.b. 4 spd.	SC	1800
2—	30	G.E. NEW b.b.	K365	1800
2—	30	G.E. NEW hitorq	KG365	1800
2—	30	Whse. NEW b.b.	CS405	1200
2—	30	G.E. TEFC b.b.	K404	1800
1—	30	Gen. Elec.	I-K	900
1—	30	Gen. Elec.	KT336	720
1—	30	Whse.	CCL	600
1—	30	Wagner	22T8P	900
1—	30	Whse. TEFC b.b.	CS405	1800
1—	30	Whse.	CS646	900
1—	25	Diehl NEW b.b.	IN405	1200
1—	25	Diehl NEW b.b.	IN404	1200
2—	25	Whse. NEW spl. b.b.	CS365	1800
1—	25	Allis Ch.	AN	1800
1—	25	Gen. Elec.	IK	1200
1—	25	Allis Ch.	AN	1200
1—	25	Gen. Elec.	KT526	900
4—	25	Whse.	CS646	900
2—	25	Gen. Elec.	I-K	600
2—	20	G.E. TEFC b.b.	K404	1200
2—	20	U.S. NEW b.b.	SC326	3600
1—	20	Gen. Elec.	KT182	3600
3—	20	G.E. NEW hitorq	KG364	1800
2—	20	G.E. NEW b.b.	K364	1800
2—	20	Delco NEW TEFC	C364	1800
3—	20	Whse. NEW b.b. spl.	CS364	1800
2—	20	Gen. Elec.	KT312	1200
2—	20	Gen. Elec.	I-K	1200
1—	20	Whse.	CS	1200
1—	20	Gen. Elec. b.b	I-K	900
1—	20	Fair. Morse	BH	900
4—	15	G.E. NEW b.b.	K324	3600
2—	15	Whse. NEW b.b.	CS326	1800
2—	15	Diehl NEW b.b.	D1326	1800
2—	15	Whse. NEW TEFC	CS326	1800
2—	15	Whse. NEW b.b.	CS364	1200
2—	15	Diehl TEFC NEW	INF 365	1200
2—	15	Gen Elec.	KT954	1800
2—	15	G.E. spl. b.b.	K365	1200
4—	15	Gen. Elec.	KT302	1200
1—	15	Gen. Elec.	KT512	900
1—	15	L. Allis	OX365	900

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10/20,000# per Hr.-200#—New-Wickes 3 drum, low head—Never installed.

30,000#/Hr.-450#—New Bros integral furnace-stoker or oil—Never installed.

BOILERS—WATER TUBE

1038 H.P. 200# Sectional Header, pulverizers, Springfield, 1927
750 H.P. 250# 4-drum, stoker, Union Iron Works, 1927
424 H.P. 425# Integral furnace, pulverizers, B&W, 1940
350 H.P. 225# Stirling, stoker, B&W, 1926
253 H.P. 180# Longitudinal drum, oil burner, Erie City, 1926
2–100 H.P. 160# 2-drum, Detroit stokers, Erie Ctiy, 1941.

TURBO GENERATORS—CONDENSING

4000 KW 2400v. 425 isp. Surf. Condenser & auxs. (2 of these)
4000 KW 2300v. 160# Wemco 1912
2500 KW 2300v. 175# Wemco 1914
1500 KW 2300v. 150# G.E. 1922
1250 KW 2300v. 200# A.C. 1924
2–750 KW 2300v. 150# G.E. 1915
500 KW 2300v. 250# Wemco 1926
6000 KW 600/6600v. 175# G.E. 1917
2000 KW 600v. 155# G.E. 1922
1000 KW 600v. 250# G.E. 1925
300 KW 480v. 400# G.E. 1942
500 KW 240v. 175# Terry S/N 7500

TURBO GENERATORS—CONDENSING EXTRACTION

3000 KW 2300v. 150#-10# Wemco 1915
500 KW 480v. 150#-10# Moore 1928

TURBO GENERATORS—NON-CONDENSING

1500 KW 2300/4000v. 200#-12# Wemco 1912
1400 KW 2400v. 175-10# A.C. Rebuilt 1942
1000 KW 2400v. 175#-10# A.C. Rebuilt 1942
500 KW 2400v. 150#-10# G.E. 1919

MOTOR GENERATOR SETS 60/3 (with controls)

1420 H.P. 11000 volts to 1000 KW 600 volts 900 RPM
1400 H.P. 4000 volts to 1000 KW 600 volts 720 RPM
710 H.P. 2300 volts to 500 KW 600 volts 720 RPM
900 H.P. 480 volts to 300/600 KW 250 volts 1200 RPM
2300 volts to 500 KW 250 volts 514 RPM
300 H.P. 2300 volts to 200 KW 250 volts 600 RPM
75 H.P. 220/440 volts to 50 KW 115/230 volts 1800 RPM
100 H.P. 2300 volts to 65 KW 125 volts 1160 RPM
290 H.P. 440 volts to 192 KW 40/80 volts 1200 RPM

ROTARY CONVERTERS with transformers & controls

60/3/4000/13200 volts to 1500 KW 600 volts 720 RPM
60/3/9900/11000 volts to 1000 KW 600 volts 360 RPM
60/3/11000 volts to 500 KW 600 volts 600 RPM (4 units)
60/3/13200 volts to 1000 KW 250 volts 360 RPM (2 units)

TRANSFORMERS 60 cycle, single phase

2—8000 KVA, 26400 to 13200 volts (auto, 3 phase)
3—3000 KVA, 22000 to 2300/4000 volts
3—1000 KVA, 11000 to 2300 volts
3— 125 KVA, 11500 to 2300 volts
3— 150 KVA, 11000 to 220/440 volts
3— 100 KVA, 7200 to 120/240 volts
2— 75 KVA, 4160/7200 to 120/240 volts
3— 167 KVA, 2400/4160 to 120/240 volts

FURNACE TRANSFORMERS 60 cycle, three phase

34000 to 220/85 volts, 1000 KVA
34000 to 164/133 volts, 1000 KVA
22000 to 228/92 volts, 4000 KVA
22000 to 260/101 volts, 4000 KVA
13200 to 240/95 volts, 5000 KVA
13200 to 239/85 volts, 4000 KVA
13200 to 239/85 volts, 3000 KVA
13200 to 239/85 volts, 2000 KVA
12000 to 200 volts, 1500 KVA
4600 to 187/75 volts, 200 KVA
230 to 120/60 volts, 200 KVA

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3—BIGELOW .....
4—BRODERICK .....
5—BROWNELL .....
6—BURNHAM .....
7—CLEAVER-BROOKS .....
8—COMBUSTION .....
9—CYCLOTHERM .....
10—DILLON .....
11—DUTTON .....
12—EDGE MOOR .....
13—ERIE CITY .....
14—FARQUHAR .....
15—FITZGIBBONS .....
16—FOSTER-WHEELER .....
17—HAMBURG .....
18—HEILMAN .....
19—HODGE .....
20—INTERNATIONAL .....
21—KEELER .....
22—KEWANEE .....
23—LEFFEL .....
24—MURRAY .....
25—OILBUILT .....
26—PACIFIC .....
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1-30 HP International, 100#
1-35 HP International, 125#
1-40 HP International, 125#

PORTABLE FIRE-TUBE BOILERS

1-45 HP Ames Economic, 125#
1-40 HP Brownell, 100#, Stoker
1-80 HP Erie City Economic, 100#
1-90 HP Erie City Economic, 125#
1-100 HP Erie City Economic, 100#
1-125 HP Leffel Scotch,
1-150 HP Erie City Economic, 150#
3-250 HP Kewanee Firebox, 125#

HOR. RET. TUBE BOILERS

1-125 HP Titusville, 125#, grates
2-165 HP Bigelow, 125#

WATER-TUBE BOILERS

2-175 HP B&W Stirling, 200#
1-250 HP Heine Box Header, 150#
1-300 HP NEW Wickes 3-drum
2-300 HP Oil City Box Hdr., 160#
1-400 HP Walsh-Wid. Sec. Hdr., 300#
1-489 HP Heine Box Hdr., 160#
1-498 HP B&W Stirling, 160#
2-500 HP B&W Sec. Hdr., 200#
1-508 HP B&W Sec. Hdr., 200#
3-509 HP B&W Sec. Hdr., 200#
2-25,000#/hr. B&W Stirling, 425#

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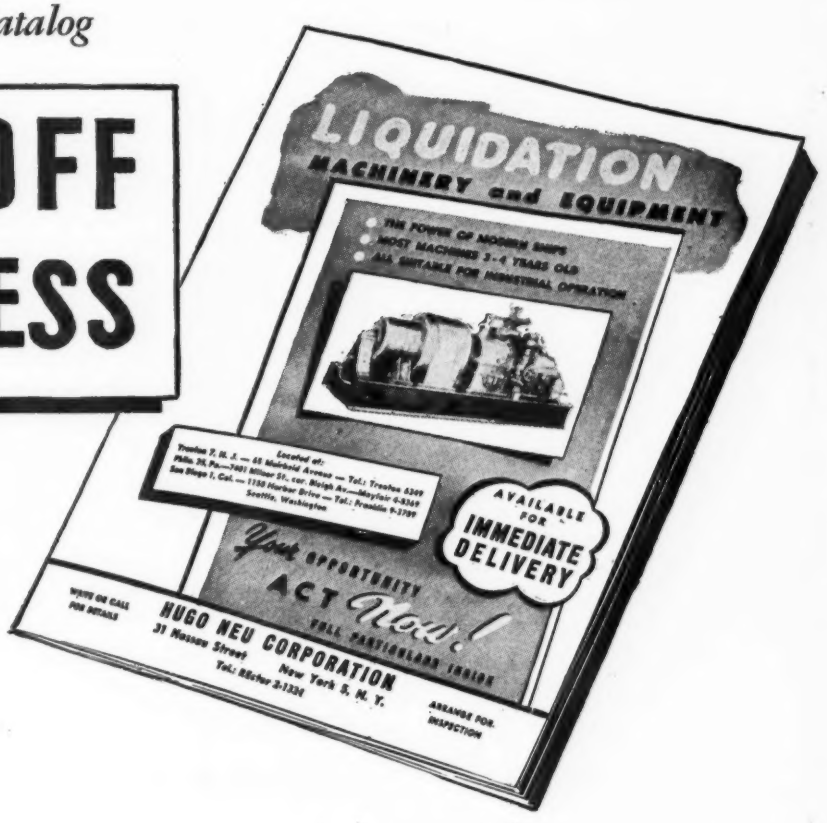

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2—6250 KW Gen Elec. Cond. 25 Cycle
1—6000 KW General Electric Cond.
1—5000 KVA General Electric Cond.
1—4000 KW General Electric Cond.
2—3750 KVA Westinghouse Cond.
1—3750 KVA Westinghouse Extrac.
1—3125 KVA General Electric Cond.
2—1250 KVA General Electric Cond.
1—1250 KVA DeLaval Cond.
2—1250 KVA DeLaval Non.-C.
2—1250 KVA Elliott Cond.
1— 225 KVA General Electric Non.-C.

STEAM ENGINE UNITS—60 Cy.

1—900 KW Hamilton Uniflow
1—750 KVA Chuse Uniflow
1—800 KVA Nordberg
1—450 KVA Ames Uniflow
1—375 KVA Harrisburg Uniflow
1—312 KVA Corliss
1—225 KVA Skinner Uniflow
1—187 KVA Ames Vertical
1—156 KVA Ames Vertical
1—150 KVA Harrisburg 4-valve
1—125 KVA Ames Uniflow

D. C. STEAM ENGINE UNITS

1—600 KW Ames Uniflow, 250 V.
1—600 KW Skinner Uniflow, 250 V.
1—500 KW Ames Uniflow, 250 V.
1—400 KW Ames Uniflow, 250 V.
1—350 KW Ridgway Uniflow, 250 V.
1—300 KW Skinner Uniflow, 275 V.
1—275 KW Ames Uniflow, 250 V.

DIESEL ENGINE UNITS

6—1600 HP Gen. Motors, 2400 V. 60 cy. gen.
3—1200 HP Hamilton 2300/4000 V. 60 cy. gen.
1— 720 HP Amer. Loco., 2400 V. DC
1— 625 HP Worthington, 240 V. 60 cy. gen.
1— 480 HP Fairbanks Morse, 2400 V. 60 cy. gen.
3— 425 HP Gen. Elec. 440 V. 60 cy.
1— 400 HP Fairbanks Morse 2300 V. 60 cy.
3— 300 HP Gen. Motors 440 V. 60 cy.
2— 30 KW Buda 6DTG-317, 3-60-127/220 V.

WATER TUBE BOILERS

1—1409 HP B. & W., 650-lb. Stoker
2— 748 HP Edgemoor 250-lb. Stokers
1— 519 HP Titusville 200-lb. Stoker
6— 509 HP Heine, 200-lb. Stokers
8— 492 HP Heine, 180-lb. Stokers
2— 469 HP B. & W. 425-lb. Pulverizer

SYNCHRONOUS MOTORS

4—6000 HP G. E. 60 cy. 2300 V. 90 RPM
2—2000 HP West. 60 cy. 2200 V. 120 RPM
1— 880 HP G. E. 60 cy. 2300 V. 514 RPM
1— 500 HP G. E. 60 cy. 2200 V. 720 RPM
1— 350 HP G. E. 60 cy. 2200 V. 720 RPM
1— 300 HP G. E. 60 cy. 2200 V. 600 RPM
1— 300 HP West. 60 cy. 2300 V. 900 RPM
1— 200 HP West. 60 cy. 440 V. 1800 RPM
1— 100 HP G. E. 2300 V. 240 RPM (Super)

INDUCTION MOTORS

1—8000/1000 HP Cr. Wh. S/R 2200 V. FL 895/448 RPM
1—1200 HP Allis Chalmers S/R 2200 V. 440 RPM
1—1000 HP West. S/R 2200 V. 360 RPM
1— 300 HP West. S/R 2200 V. 1800 RPM
1— 200 HP G. E. S/C 2300 V. 1800 RPM
1— 200 HP G. E. S/R 2200 V. 435 RPM
2— 150 HP Al. Ch. 2300 V. 1800 RPM. New.
1— 150 HP Cr. Wh. 440 V. 1800 RPM. New.
2— 150 HP Burke S/C 440 V. 1800 RPM. New.
4— 125 HP Al. Ch. S/C 440 V. 435 RPM
1— 100 HP Louis Allis S/C 220/440 V. 1800 RPM
1— 60 HP West. S/C 2300 V. 1200 RPM

MOTOR GENERATOR SETS

1—1500 KW Allis Chal. 600 V. DC 60 cy.
1—1000 KW Gen. Elec. 275 V. DC 60 cy.
1— 500 KW Cr. Wh. 600 V. DC 60 cy.
1— 400 KW Cr. Wh. 275 V. DC 60 cy.
1— 400 KW Allis Chal. 275 V. DC, 25 cy.
2— 300 KW Allis Chal. 275 V. DC, 25 cy.
1— 300 KW West., 250 V. DC 60 cy.
1— 250 KW Allis Chal., 275 V. DC, 25 cy.
1— 200 KW G. E. 60 V., DC, 60 cy.
1— 200 KW West. 250 V. 3 W. 60 cy.
1— 192 KW West. 40/80 V. DC, 60 cy.
2— 150 KW Elec. Mcy. 250 V. DC, 60 cy.
1— 75 KW West. 125 V. DC, 60 cy.
1— 50 KW West. 125 V. DC, 60 cy.

ROTARIES—60 Cy.

1—2000 KW Allis Chalmers 600 V.
1—1000 KW Gen. Elec. 600 V.
1—1000 KW Westinghouse 240 V.
1— 750 KW Westinghouse 275 V.
1— 750 KW General Electric 600 V.
1— 500 KW General Electric 275 V.
2— 500 KW Westinghouse 600 V.
1— 300 KW Westinghouse 600 V.
2— 300 KW Westinghouse 250 V.

FREQUENCY CHANGERS

1—2150 KVA G. E. 25/62½ cy. 750 RPM
1—1875 KVA G. E. 25/60 cy. 300 RPM
1—1200 KVA G. E. 25/60 cy. 300 RPM
2—1000 KVA G. E. 25/60 cy. 300 RPM
1— 938 KVA West. 25/62½ cy. 750 RPM
1— 600 KVA G. E. 60/25 cy. 300 RPM

TRANSFORMERS—60 Cy.

3—40,000 KVA Al. Ch. 63500/110000 W—13800 V.
8— 833 KVA Al. Ch. 33000—4800 V.
3— 3750 KVA West. 26400/13200—2400 V.
1— 1000 KVA G. E. 24000-11500 V. 3 ph.
2— 1000 KVA G. E. 23000-11500-575 V.
3— 750 KVA West. 22000-2300/4600 V.
2—10,000 KVA Pitts. 13200-4600 V. 3 ph.
3— 500 KVA West. 13200-2300/4600 V.
2— 1000 KVA G. E. 11500/23000—575 V.
1— 8000 KVA Penn. 6400/13200—2400 V. 3 ph.
1— 1500 KVA West. Auto 4000-2300 V. 3 ph.
1— 2500 KVA Penn. 4150-480 V.
3— 167 KVA G. E. 2400/4160 Y—120/240 V.
3— 667 KVA G. E. 2300—575 V.
1— 400 KVA G. E. 2300—550 V. 3 ph.
1— 100 KVA G. E. 2300—575 V.
3— 20 KVA West. 2200—575/287½ V.

OIL CIRCUIT BREAKERS

1—	400 A.	37 KV West. G11	Outdoor
2—	400 A.	25 KV G. E. FK0136	Outdoor
2—	1000 A.	23 KV Kelman CB76	Outdoor
6—	600 A.	15 KV.G. E. FK255	Indoor
4—	600 A.	15 KV G. E. FHK0139-24BS	Outdoor
1—	600 A.	15 KV G. E. FK037	Pole type
2—	400 A.	15 KV G. E. FHK0136	Outdoor

PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW, WOLTMAN & CO., INC.

50 Church Street New York City 7, New York

POWER PLANT EQUIPMENT

Special Offerings

TURBO-GENERATORS

1—3500 KW 480 V Cond.
2—2500 KW 440 V Cond.
1—3000 KW 600 V Cond.
1—2000 KW 600 V Cond.
1—2000 KW 480 V. N. C.
2—1500 KW 2300 V Cond.
1—1250 KW 2300 V Cond.
2—1000 KW 440 V Extrac.
1—1000 KW 2300 V Cond.
2— 500 KW 600 V Cond.
1— 500 KW 240 V Cond.
2— 125 KW 220/440 V N. C.
1— 250 KW 2300 V N. D.
1— 125 KW 600 V Extrac.
1— 50 KW 220 V AC. N.C.

ENGINE GENERATORS

1—375 KW 2300 V Uniflow
1—168 KW 600 V.
2—280 KW 480 V.
1—250 KW 480 V.
1—150 KW 180 V.
1—125 KW 125/250 V.D.C. Uniflow

TURBINES ONLY

1—375 H.P. with gears
1—210 H.P. Terry 250#

BOILERS

2—30,000# 425 PSI
1—1030 HP 225#
1— 500 HP 400#
4— 500 HP 200#
2— 480 HP 225#
2— 400 HP 180#
1— 250 HP 180#
2— 175 HP 200#
1— 150 HP 150#
1—100 HP 133# Scotch
1— 75 HP 150# New
1— 50 HP 200#

AIR COMPRESSORS

1—6000 CFM 50# Motor
1—2700 CFM 100# Motor
1—1200 CFM 100# Belted
1— 700 CFM 100# Belted
1—5000 CFM 10# Rotary Type 440 V Syn. Motor
1—6000 CFM 5.1# New

TRANSFORMERS

3—200 KVA 600/220/110

MOTOR GENERATORS

1—100 KW 550/125 V

Write or wire for additional data and prints.

A. LEE ELLIS CO., U. S. Machy. Bldg., 140 Federal St., Boston 10, Mass.

The Buyers Must Be Satisfied—Always

MOTOR GENERATORS

Brand new. Built by Allis Chalmers to rigid specifications of the U. S. Navy

K.V.A. output 1,250 R.P.M. 3600
K.W. output 1. Cont. Duty Ph. Single
P.F. 80 Cycles 60
Volts input 115 D.C. Volts output 120 A.C.
Amps input 14 Amps output 10.4
Length 26"; width 12⅞"; height 13"

Compound accumulative A.C. and D.C. fields. Centrifugal starter. Splashproof covered. Frequency adjustable to load, plus or minus five cycles.

PRICE $87.50

Identical Machine, but 230 volts D. C. Input, $125.00

Set of Replacement Spart Parts for Either Machine $29.50

Prices f. o. b. Tuckahoe, New York
Immediate Delivery

ELECTRONICRAFT, INC.
5 Waverly Place Tuckahoe 7, New York
Phone Tuckahoe 3-0044

MARINE and INDUSTRIAL EQUIPMENT

NORTHERN METAL COMPANY
SHIP BREAKERS

Immediate Delivery

BOILERS

FOSTER-WHEELER
Capacity Steam Per hr. 60000# with superheater.

WICKES
Capacity Steam Per hr. 55000# working pressure 250#

BABCOCK & WILCOX
Capacity Steam Per hr. 22500# working pressure 250#

CLEAVER BROOKS
Package Type with feed pump, 100# designed pressure

PUMPS

Rotary Pumps Turbine Drive
Centrifugal Pump Turbine Drive
Centrifugal Pumps Motor Dr. *(Vertical & Horizontal)*
Reciprocating Pumps Duplex *(Vertical & Horizontal)*
Reciprocating Pumps Simplex *(Vertical & Horizontal)*

DIESEL ENGINES

G.M. 900 HP Model 12-567, 2 cyc., 12 cyl, 8½" x 10", 744 rpm, with Falk reversing and reduction gear, ratio 2½ to 1. Electric Starting. Auxiliaries Available.

DIESEL GENERATORS

100 KW. D.C. Generators, 240-120V, 417 Amps, 1200 rpm., Driven by Superior Diesel, 150 H.P. model GBD-8, 8 cyl. 5½" x 7", Electric starting. Auxiliaries Available.

D.C. Generators: Delco model 1-3642 Ser. No. 541342 100 KW, 120/240 V. 1200 rpm, 417 amps. Driven by General Motor Diesel Engine Model 3-268-A Eng. No. 10080, 150 H.P. 1200 rpm. 3 cyl. 6½"x7", 2 cyc. Auxiliaries Available.

WINCHES—WINDLASSES

Winches (WELLIN DAVIT)
25 H.P. 230 V. D.C. 90 amps. 1750 rpm.

Winches (TOWING)
50 H.P. 230 V. D.C. 525 rpm.

Winches (ELEVATOR)
20 H.P. 17.6 KW 230 V. D.C. 30 rpm. Gear motor

Windlass
20 H.P. 230 V. D.C. 1150 rpm. Gear Motor

OTHER WINCHES & WINDLASSES
AVAILABLE FOR
Cargo—Mooring—Towing

TURBO-GENERATORS

Turbo Generators, 300 KW A.C. G.E.
Generator: 450 V. 300 KW 3 phase 60 cyc. 481 Amps. 1800 rpm.
Exciter: DC 40 KW, 330 amps. 120 V. full load.
Reduction Gear: Ratio 4.061, 4873 to 1200 rpm.
Turbine: 340 KW G.E. 400# W.P. 3 stage condensing

Turbo Generators, 132 KW AC General Electric
Generator: 450 V. and 220V 3 ph. 60 cyc. 1200 rpm., 251 Amps.
Exciter: 120 V. D.C. 22.6 amps. 40 KW
Reduction Gear: 8.4 to 1 ratio
Turbine: 172 KW 10071 rpm. 3 and 5 stage

OTHER
TURBO-GENERATORS—MOTOR GENERATORS
STEAM ENGINE DRIVEN GENERATORS
AVAILABLE

YOUR INQUIRIES INVITED

NORTHERN METAL COMPANY

MILNOR & BLEIGH STS. *Phone:* MAYFAIR 4-1400 **PHILA. 35, PA.**

MOTORS • GENERATORS • TRANSFORMERS

MOTORS
3 PHASE—25 CYCLE—220 440 VOLTS

H.P.	Make	Type	Frame	RPM
5	West.	CS		750
5	West.	CS		750
5	West.	CS		750
5	West.	CS	453	750
5	West.	CS	453	750
5	G.E.	KT	948	1430
5	G.E.	KT	948	1430
5	G.E.	KT	948	1430
10	G.E.	KT	312	750
15	G.E.	I Form K		750
15	West.	CS	573	750
20	West.	CS		730
25	West.	CS		730
40	G.E.	I Form K		750
75	G.E.	I Form K		500
100	G.E.	I Form K		750
100	West. (2200 v.)	CS	571/526	460
125	West (S.R.)	CW		480
150	G.E.	I Form K		365
150	G.E. (2200 v.)	I Form K		750
150	G.E. (2200 v.)	I Form K		750
150	Allis Ch.	Slip Ring		720
150	G.E. (2200 v.)	KT b.b.	557Y	1470
200	West. (2200 v.)	CS	1013	480
200	G.E. (2200 v.)	I Form K		485
200	G.E. (S.R.)	I Form M		480
200	West. (S.R.)	CW	1011	480

2300 VOLT PRIMARY CONTACTORS

1—225 HP. Square D Magnetic Controlled, 3/60/2200 Volts.

1—200 Amp Schweitzer-Conrad Load Break, 3 Pole Fused, 3/60/2300 Volts.

FREQUENCY CHANGERS

All Sizes in Stock. 60 cycle to 90 cycle. 100 cycle, 120 cycle, 180 cycle and any other high cycle if desired.

HORIZONTAL & DUPLEX
Compressors & Vacuum Pumps after Coolers, Filters

25 CYCLE MOTORS

1—1270 HP. Gen. Elect. Synchronous Motor Type A.T.I. 3/25/2200 Volts 150 RPM.

1—1900 HP. Gen. Elect. Synchronous Motor Type A.T.I. 3/25/2200 Volts 150 RPM.

MOTOR GENERATOR SETS

2—350 KW General Electric Sets 250 Volts D.C. driven by 500 HP 3 Phase 25 Cycle motors.

1—30 KW Gen. Elec. Generator, Type DLC-203, 125 v. direct connected to 40 HP Gen. Elec. Motor, 3/440, 60/720 RPM with panel board.

ROTARY CONVERTER

1—2000 KW Westinghouse Booster type Rotary Converter 230 Volt D.C.—3 to 6 Phase, 25 Cycle, 4600 Volt Transformer.

NEW MOTORS

300 New Gen. Elect. & Westinghouse Motors in stock from 1 to 100 H.P.

MOTORS

1—75 HP. Gen. Elect. Type I Form K. 3/60/440/720 RPM.

1—75 HP. Fynn-Weischel Synchronous 3/60/440/1200 RPM.

1—75 Gen. Elec. Slipring Type I Form M., 3/60/440/450 RPM.

1—100 HP. Gen. Elect. Type K (New Motor) 3/60/440/1800 RPM.

1—100 HP. Westinghouse Slipring Type CW, 3/60/440/435 RPM.

1—100 HP. Gen. Elect. Slipring Type I Form M, 3/60/440/3200/720 RPM.

1—100 HP. Westinghouse Motor Type CS-867A, 3/60/440/885 RPM.

1—100 HP. Westinghouse Slipring Type CW 3/60/440/1200 RPM.

1—170 HP. Crocker Wheeler Slipring 3/60/440/600 RPM.

1—200 HP. Gen. Elect. Slipring Type I Form M, 3/25/440/500 RPM.

1—500 HP. Allis Chalmers Slipring 3/60/2300/514 RPM.

1—500 HP. Gen. Elect. Type I Form K, 3/25/440/485 RPM.

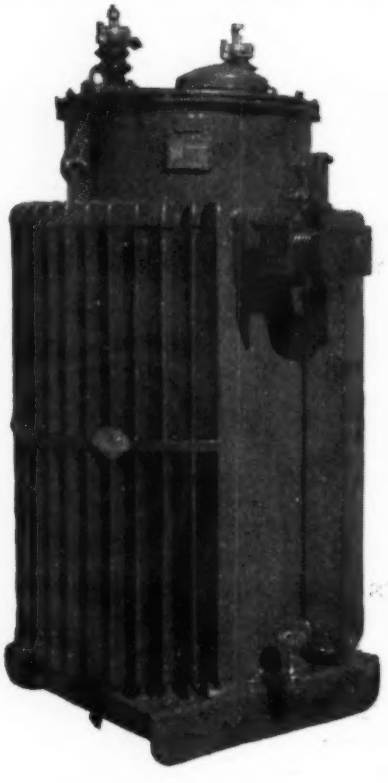
1—600 HP. Westinghouse Motor Type CS, 3/25/550/490 RPM.

1—600 HP. Gen. Elect. Slipring Type MT, 3/25/550/490 RPM.

1—1500 HP. Allis Chalmers Synchronous, 3/60/2300/164 RPM.

ERIE ELECTRIC CO., INC. 124 CHURCH ST. BUFFALO, N. Y. CL. 4758

LATEST DESIGN • PROMPT SHIPMENT



TRANSFORMERS

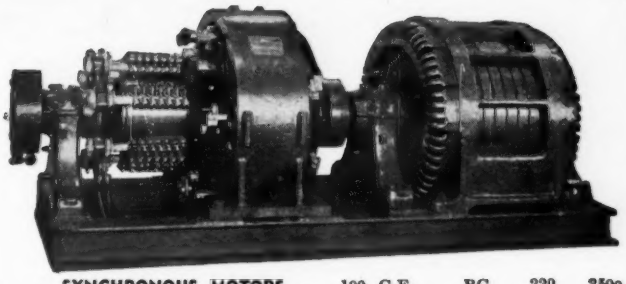
General Electric, Spirakore, type HS, 167 KVA, 2400/4160Y volts primary, 120/240 volts secondary, single phase, 60 cycle, oil cooled.

Alternative with the same rating except having a secondary voltage of 240 or 480.

GLOW ELECTRIC CO. 933 HARRIET Cincinnati 3, Ohio

QUALITY REBUILT POWER EQUIPMENT

Why wait for costly breakdowns? Increase your production now by ordering Chicago Electric rebuilts while stocks last—



QUALITY POWER EQUIPMENT

MOTOR GENERATOR SETS

KW	Make	A. C.	D. C.
1000	G.E.	4000/2530	600
800	Whse.	13200	250
600	G.E.	6600	250
350	G.E.	440	250
150	G.E.	2300	275
90	G.E.	2300	110
75	G.E.	2300	125
75	El. Pdts.	220	125
70	G.E.	440	125
65	G.E.	440	125
60	Al. Ch.	2300	110
40	Bogue	220/440	125/250
40	G.E.	220/440	125
35	G.E.	220	40
30	G.E.	220/440	230
25	Watton	220	97/111

SQUIRREL CAGE MOTORS

HP	Make	Type	Volts	Speed
800	Whse.	CS	2200	706
500	Elliott		2300	720
500	G.E.	IK	440	1200
350	Lincoln		440	900
300	Whse.	CS	440	400
250	Whse.	CS	440	1200
200	Whse.	CS	440	900
200	Al. Ch.	AR	2200	900
150	G.E.	K	440	1800
125	G.E.	TEFC	440	1180
125	Al. Ch.		440	435
125	Howell	CS	2200	1200
100	Al. Ch.	AR	440	495
100	Century	SC	440	1800
75	Al. Ch.	AR	2200	1765
60	G.E.	K	440	1800
60	Al. Ch.	AR	440	495
50	Al. Ch.	AR	440	1800
50	G.E.	IK	440	900

SLIPRING MOTORS

HP	Make	Type	Volts	Speed
1000	Whse.	HR	2300	360
750	Whse.	CW	2300	440
600	G.E.	I	6600	300
600	G.E.	M	440	1775
435	G.E.	I	4000	1180
400	Al. Ch.	NO	440	600
350	G.E.	IM	440	720
300	Al. Ch.		2300	505
300	G.E.	IM	440	720
300	G.E.	I	440	1800
250	Whse.	CW	2200/400	345
250	Whse.	CW	2200	580
200	Cr. Wh.		220	600
175	Ideal		440	585
150	G.E.	IM	2200	1800
100	G.E.	IM	440	720
50	Louis Als.	GH	440	870

SYNCHRONOUS MOTORS

HP	Make	Type	Volts	Speed
2100	G.E.	ATI	4600	514
900	Al. Ch.	AL	2300	150
600	G.E.	TS	4160	1200
500	Whse.		2300	514
450	El. Ma.	BRG	440	240
430	G.E.	ATI	2200	720
400	G.E.	TS	440	600
300	G.E.	TRC	440	240
300	E. M.		440	900
250	G.E.	TS	2300	600
60	G.E.	TS	220	1200

GEARHEAD MOTORS

HP	Make	Type	Volts	Speed
5	G.E.	K	220/440	98.9
3	Sterling	KFA	220/440	350
3	G.E.	RT	440	488
2	Sterling	KFA	220/440	230
2	Sterling	KFB	220/440	59
2	U. S. El.	GH	220/440	230
1½	G.E.	K	220/440	230
1½	G.E.	K	220/440	37
1½	Sterling	KFB	220/440	88
1	U. S. El.	GH	220/440	350
1	U. S. El.	GS	220/440	190

D.C. MOTORS

HP	Make	Type	Volts	Speed
430	G.E.	MPC	250	950
300	G.E.	MP	250	425
100	G.E.	RC	220	2500
60	G.E.	CD	550	1000
45	Whse.	S	250	620
40	Cr. Wh.	CCM	230	575
40	G.E.	E	220	620
35	Cr. Wh.	CM	220	840
35	N. W.		230	1275
30	Cr. Wh.	CCM	220	450
30	Al. Ch.	Bullock	230	575
27½	G.E.	CL	220	745
25	Whse.	S	220	850
25	N. W.	K	230	900
25	G.E.	CL	220	725
25	Marble Card.		220	1800
20	Cr. Wh.	CM	230	775
20	Al. Ch.	E	230	1150
20	Whse.	SK	230	975
15	G.E.	CVC	230	925
15	Cr. Wh.	CM	230	800
15	G.E.	RC	230	1150
13	L. A.	NA	230	600
10	G.E.	CD	230	1150

A.C. GENERATORS

Kva	Make	Type	Volts	Speed
2500	G.E.		480	3600
1625	Whse.	ES	2300	240
938	Whse.		2200	720
450	Al. Ch.		440	360
225	G.E.	TS	440	600
175	Al. Ch.		480	600

NEW DIESEL GENERATOR

60 KW, 75 KVA Electric Machinery, A.C. generator, 3 phase, 60 cycle, 230/400 volts, 4 wire, .8 P.F., 108.5 amps, 600 RPM, with 2 KW Elec. Mach. 125 volt exciter, direct connected to Ollwell Diesel, model 10060-4YD, size 81/4x9 on fabricated steel base.

HIGH FREQUENCY M.G. SET

New 2 KVA A.C. generator Onan, model 223G, 1 phase, 800 cycle, 115 volts, 17.3 amps, 1.0 P.F. 2666 RPM, frame 21433, belt driven by 5 HP motor, General Electric, type K254, 3 phase, 60 cycle, 220/440 volts, 1800 RPM, ball bearing, with V-belt drive and guard, on fabricated steel base.

CHICAGO ELECTRIC COMPANY

1330 WEST 22nd STREET • • • CHICAGO, ILLINOIS

NEW AC MOTORS

3/60/220/440 VOLTS

Quan.	HP	Speed	Remarks
3	½	1200	220 V.-T.E.
1	½	1200	T.E.
1	½	1800	T.E.N.V.
3	1	1200	T.E.
1	1	1200	X.P.
1	1	1800	220 V.-X.P.
2	1½	1200	T.E.
1	1½	1200	T.E. w/Brake
1	1½	1800	T.E.
1	1½	1800	X.P.
2	1½	3600	T.E.
6	2	1200	T.E.F.C.
1	2	1800	X.P.
1	2	1800	Open
1	2	3600	T.E.
2	2	3600	T.E.F.C.
1	3	1200	X.P.
1	3	1200	208 V.-X.P.
2	3	1800	T.E.F.C.
3	3	3600	T.E.F.C.
1	5	1200	X.P.
6	5	1200	T.E.F.C.
1	7½	1200	T.E.F.C.
1	7½	1200	X.P.

1/60/110/220 VOLTS

7	1	1200	T.E.
3	1½	1800	X.P.
1	2	1200	Open
1	3	1800	Open

NEW GEAR MOTORS

3/60/220/440 VOLTS

Quan.	HP	Output RPM	Remarks
1	¼	96	440 V.-Open
1	¼	72	Open (1/60/110 Volts)
1	½	72	440 V.-Open
1	1½	86.2	Open
1	½	290	Open
1	1	37	Open
1	1	45	Open
1	2	98.9	Open

MOTORS

1—125 H.P. West. Squirrel Cage, 3/60/2200 volt, 1800 RPM and Starter.

1—20 H.P. General Electric Induction Motor, 3/60/220 v., 1160 RPM.

2—Vertical Gear Head Motors, Crocker Wheeler, TEFC 10 H.P., 220/440 volt, 60 cycles, 3 phase, 1745 RPM. Philadelphia Gear, output 425 RPM.

1—10 H.P. Sterling Type KRE enclosed Speed-trol motor 3/60/220/440 volt, 1350/900 RPM.

CARRIER AIR CONDITIONING UNIT

1—30 ton Carrier Air Conditioning Unit consisting of two—2 cylinder Compressors and two—15 H.P. Motors mounted on common base; with Kathabar Unit complete with all accessories, starters and instruments. Electrical characteristics 3/60/220/440. New 1942. Has been in use one season.

AIR COMPRESSOR

1—Ingersoll-Rand Compressor Type 40, 7" & 6¼" x 5" delivering 156 CFM at 100# with 40 H.P. Gen. Elec. TEFC motor, 3/60/220/440 volt, 900 RPM, Receiver and Control.

SPEED REDUCERS

4—Philadelphia Worm Gear size 00 type AT 1.65 H.P., 1750 RPM, 5-1/6 to 1 ratio.

1—Cleveland Worm Gear 100 AH, series 25, 12 H.P., 1140 RPM, 5¼ to 1 ratio.

Heat and Power Co., inc.

70 PINE STREET • DIGBY 8-0373 • NEW YORK 5, N. Y.

SLIP RING MOTORS
3-PH., 60 Cy.

HP	Volts	Make	Speed
200	2200, 440	G.E.	600
200	440/220	G.E.	720
125	440/220	G.E.	600
150	440/220	Whse.	1200
125	440/220	G.E. (Hoist)	900
100	440/220	G.E.	720
100	440/220	G.E. (MTC)	900
100	2200/440	G.E.	600
80	440/220	G.E. (MTC)	900
75	2200/550	G.E.	900
60	440/220	G.E.	1200
60	440/220	Cr. Wh.	720
50	440/220	G.E.	900
40	440/220	G.E.	720

SYNCHRONOUS MOTORS
3-PH., 60 Cy.

HP	Volts	Make	Type	RPM
400	440/220	G.E.	ATI	600
300	2200/440	G.E.	ATI	600
250	440/220	Whse.	HR	277
240	2200/550	G.E.	ATI	900
240	440/220	G.E.	ATI	720
200	4150/2300	Whse.	G	1800
200	2200	G.E.	ATI	514
150	4150/2300	G	G	1800
150	440/220	G.E.	ATI	900
150	2200/440	G.E.	TS	600
125	2300	G.E.	TS	327
110	440/220	G.E.	TS	1800
110	440/220	G.E.	TS	257
100	440/220	G.E.	TS	900
100	440, 220/25 cy	G.E.	TS	375
100	440/220	Whse.	G	1800
75	2200/440	Whse.	G	600
75	440/220	G.E.	TS	900

AIR COMPRESSOR UNIT
1—13" and 8" by 10" Worthington FEATHER-VALVE, 285 rpm, 110 lbs. ga., motor-driven, complete

CIRCUIT BREAKERS
1—2000 amp., ITE—3 pole—600 v., air circuit breaker
1—New 2500 amp., 600 v., type DA 75, 3 pole, Whse. air circuit breaker

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
600	2300/440	G.E.	KT	1200
500	440/220	G.E.	IK	900
400	550	G.E.	IK	720
300	2200/440	Whse.	CS	600
300	440/220	G.E.	KT	1800
200	2200/550	Cr. Wh.	SC	900
200	2200/440	G.E.	KT	1200
200	440/220	G.E.	IK	600
200	440	Whse.	CS	900
150	440/220	Howell	B. Brg.	1800
150 vert.	440/220	G.E.	KTP	1200
125 vert.	440/220	G.E.	KTP	1200
125	440	G.E.	KT	600
100	440/220	G.E.	KT	450
100	440/550	G.E.	KT	400
100	440	Whse.	CS	1800
75	440	G.E.	KT	360
75	550/220	G.E.	KT	1200
75	440	G.E.	KT	400

TURBO-GENERATOR
Generator, 125 kva. 1200 rpm. 440/220 v., Whse., dir. conn. by reduction gear to Turbine, 100 kw. 7380 rpm. non-condensing, 150/200 lbs. ga. pr., complete with dir. conn. exciter and switchboard; practically new condition, never used.

A. C. GENERATORS
1—320 kva., 600 rpm., 440/220 v., G.E.
1—300 kva., 600 rpm., 2200/440 v., G.E.
1—225 kva., 900 rpm., 2200/550 v., G.E.
1—225 kva., 720 rpm., 440/220 v., G.E.
1—190 kva., 514 rpm., 220/440 v., G.E.
1—150 kva., 900 rpm., 440/220 v., G.E.
1—100 kva., 327 rpm., 2300 v., G.E.
1— 98 kva., 1800 rpm., 440/220 v., G.E.
2— 75 kva., 1800 rpm., 440/220 v., Whse.
2— 75 kva., 1200 rpm., 440/220 v., G.E.
2— 30 kw., 1200 rpm., 440/220 v., G.E.

MOTOR GENERATOR SETS
1—125 kw., 250 v., 1200 R. Cr. Wh. conn. to 200 hp. 2200/440 v., 3 ph., Sq. C. motor.
1—100 kw., 125 v., 1200 rpm. Whse., conn. to 150 hp. 440/220 v., 3 ph. syn. motor.
1—75 kw., 250 v., 1200 rpm. Whse., conn. to 112 hp. 440/220 v., sq. cage motor.
1—60 kw., 125 v., 1200 rpm. Whse., conn. to 75 hp. 440/220 v., 60 cy., syn. motor.
1—25 kw., 440/220 v., 1800 rpm. G.E. alternator conn. to 40 hp. 230 v., DC motor.

TRANSFORMERS
60 Cycle
1—1000 kva. Al. Chal., 2400-120/240/208 volts, 3 phase. NEW.
1—400 Kva. G.E. 2300-230/115 v.
3—200 kva. Al. Chal., 2400-120/240 volts. NEW.
1—150 kva. Whse. SK. 13200-125/215 v. 3 ph.
6—100 kva. G.E. 4600/2300-230/115. NEW.
3—50 kva. Whse. 4600/2300-230/115.
6—37½ kva. Whse. 440-115. DRY.
3—25 Kva. G.E. 7200-120/240. NEW.
3—25 kva. G.E. 2300-230/115. DRY.

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SIX—400 H. P.—225 LB. STEEL ENCASED CROSS DRUM TYPE—WATER TUBE BOILERS—OIL FIRED.

ONE—400 H. P.—300 LB. WATER TUBE, CROSS DRUM TYPE BOILERS, ASME.

ONE—2500 KW 3 PHASE, 60 CYCLE, 2300 VOLT, CONDENSING WESTINGHOUSE, TURBO GENERATOR. FEBRUARY DELIVERY.

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342 MADISON AVENUE NEW YORK 17, N. Y.
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MOTORS
2200V 60 CYC, 3 PH.
1— 50 H.P. G.E. KR 527, 1800 RPM.
1— 50 H.P. G.E. MT slipring, 695 RPM.
1— 60 H.P. Westinghouse CS SB 1800 RPM.
1—100 H.P. G.E. KT 1800 RPM.
1—100 H.P. G.E. I-K 1800 RPM.

220 or 440V.
1—7½ H.P. G.E. MT 760, 1800 RPM.
1—15 H.P. West. CW 900 RPM.
1—30 H.P. West. CI 638, 900 RPM.
1—30 H.P. West. CI 690 RPM.
1—30 H.P. West. CW 900 RPM.
1—35 H.P. G.E. ITC 5012 1200 RPM.
1—25 H.P. West. CI 652-D 690 RPM.
1—50 H.P. West. CW 690 RPM.
1—50 KW West. SK 125 volt 1150 RPM. compound Gen. with control panel.
3—5—7½—10 H.P. Westinghouse SK, 850 RPM., 230 V. reasonable.

Penn Electrical Engineering Co.
SCRANTON, PA.

STEAM TURBO UNIT
60 CYCLE
For Immediate Delivery
1—3000 K.W., 3750 KVA. Westinghouse CW 46, 2 Stage Reaction Type Single Flow Condensing Turbo 150/200# steam pressure, Alternator 3 phase, 60 cycle, 2300 volts, 3600 RPM.
Unit recently entirely overhauled by manufacturer.
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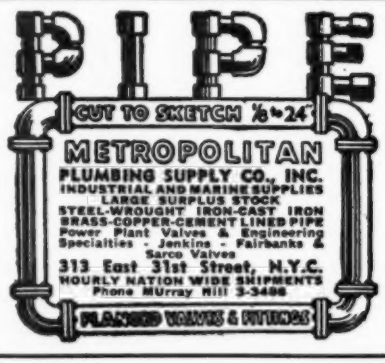
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1—50 KVA Peer Auto. Press Type, Combination Spot & Projection Welder, Air Operated, equipped with Contactor & Magnetic Timer.
FOLLOWING MANUALLY OPERATED
1—30 KVA Peer, 24" adjustable arms
1—20 KVA Winfield 18" adjustable arms
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All Above Single Phase, 60 Cycle, 220 Volt.
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NEW ILG MARINE BLOWER FANS
24"—6250 C.F.M. 33"—16000 C.F.M.
36"—15000 C.F.M.
Axial Flow—Propeller Type. Driven by 230 volt DC Motors.
ELECTRIC APPARATUS REPAIR CO.
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CRANES-MOTORS and ELECTRICAL EQUIPMENT

ENGINEERED AND REBUILT BY SPECIALISTS IN OUR MODERN PLANT

SQUIRREL CAGE MOTORS
3 PHASE 60 CYCLE

Qu.	H.P.	Make	Type	Volts	R.P.M.
7	10	Whse.	C.S.	440	575
1	10	G.E.	KT-753	440	880
1	10	G.E.	K-324	208	1750
1	10	Al. Ch.	X	220	1750
1	20	G.E.	I.K.	220	565
1	20	Whse.	C.S.	550	1750
1	25	G.E.	F.T.R.	220	575
2	25	G.E.	K.T.	220	900
1	25	Whse.	C.S.	220	1160
1	30	Whse.	C.S.	550	900
1	35	G.E.	I.K.	2200	1200
1	40	F.M.	H	220	860
2	40	Al. Ch.	A.R.	440	860
1	40	F.M.	B	220	1150
1	40	G.E.	K.T.	220	1800
1	40	Whse.	CS-650	2200	1760
1	50	G.E.	I.K.	440	695
1	50	Whse.	C.S.	220	870
1	50	G.E.	K.T.	440	1160
1	80	Ideal	A.T.	440	1750
3	75	Al. Ch.	A.R.	220	1750
2	100	G.E.	I.K.	2300	695
5	100	F.M.	HS201C	440	900
4	125	Al. Ch.	A.R.	440	435
1	125	Whse.	CS-761	440	1750
3	125	Al. Ch.	A.R.	2200	1750
2	135	G.E.	KF542	440	1200
1	200	G.E.	I.K.	2300	490
1	200	Al. Ch.	A.R.	2200	3550
1	250	Whse.	C.S.	2200	1160

3—200 hp GE-KG 557Z 440/3/60 cy 1750 RPM—BB.—FC.—TE.

SYNCHRONOUS MOTORS
3 PHASE 60 CYCLE

Qu.	H.P.	Make	P.F.	Volts	R.P.M.
1	30	Whse.	.8	220	1800
2	50	G.E.	.8	2200	600
1	60	G.E.	.8	440	1200
1	100	G.E.	.8	440	900
1	100	Whse.	1.0	2200	1200
1	150	G.E.	.8	440	900
1	150	G.E.	1.0	2200	900
1	150	G.E.	.8	2200	1200
1	500	G.E.	.8	2200	720
1	885	G.E.	.8	6600	514

CAN FURNISH ABOVE WITH EXCITERS, REDUCED VOLTAGE MAGNETIC OR SEMI-MAGNETIC OR FULL VOLTAGE MAGNETIC CONTROLLERS.

SLIP RING MOTORS
CONSTANT DUTY
3-PHASE 60-CYCLE

Qu.	H.P.	Make	Type	Volts	R.P.M.
2	5	Al. Ch.	ARY	440	720
3	10	G.E.	I-M	220	1120
2	15	G.E.	I-M	220	1200
1	20	G.E.	MT-326	220	900
2	25	G.E.	MT-326	2200	850
4	25	G.E.	MT-526	440	900
2	25	Whse.	CW-481	440	1750
1	30	Al. Ch.	ARY	440	900
1	30	Whse.	CW	440	1160
1	40	Al. Ch.	ANY	2200	435
3	40	G.E.	MT-346	550	560
1	40	Whse.	CW-644	220	870
3*	40	G.E.	I-M	600	1170
1	50	Al. Ch.	ARY	2200	490
2	50	G.E.	MT-536	2200	1200
1	75	G.E.	MT-548	440	1200
1	75	Al. Ch.	ARY	440	1750
1	100	G.E.	MT-356	440	900
2	125	G.E.	MT-558	2200	900
1	150	Whse.	CW	2300	1200
1	200	C.W.	127AQ	440	590
1	200	G.E.	I-M	2200	580
1	250	Whse.	CW	2200	580
1	300	G.E.	MT-412	2200	360
1	300	G.E.	IM	2200	1200
1	300	Al. Ch.	ARY	2200	514
1	300	G.E.	IM	440	580
1	400	Whse.	CW-1108	2300	600
1**	1200	Whse.	CW	2300	590

*—40 cycle. **—Heavy duty mill type.

CAN SUPPLY THE ABOVE WITH PRIMARY CONTROL (OCB OR MAGNETIC) SECONDARY CONTROL (NON-REV. DRUM CONTROLLER OR FULL MAGNETIC) WITH STARTING DUTY OR VARIABLE SPEED REGISTERS.

TRANSFORMERS
OIL-COOLED

Qu.	K.V.A.	Make	Voltage	Ph.	Cy.
3	25	G.E.	1100/ 2200/ 608	1	40
3*	37½	Whse.	460/ 230/ 230/115	1	60
2	50	Wag.	132000/11880/ 575/287	1	60
3	130	G.E.	19000/ 9500/ 550/2200	1	60
6	165/ 247	G.E.	38100/22000/11000/430/215	1	60
1	200	Whse.	3810/ 2300/ 440	3	60
3	200	G.E.	2400/4500-Y138/230/460	1	60

MOTOR GENERATOR SETS

1—9 KW. G.E. CD. 250-VDC., dir. con. 15-HP. G.E. Sq. Cg. Motor, 220/440-V., 3-Ph., 60-Cy., 1800-RPM.

4—25 KW. Whse. SK, 3-wire, 120240-VDC., 1200-RPM., dir. con. 40-HP. Sq. Cg. Motor, 220/440-V., 3-Ph., 60-Cy.

2—3-Unit Sets, (2) 25 KW. Whse. SK, 3-wire gen. 120/240-VDC., 1200-RPM., dir. con. 75 or 100-HP. Sq. Cg. or Syn. Motor, 220/440 and 2200-V., 3-Ph., 60-Cy.

1—50 KW. Louis-Allis, 124/240-VDC., dir. con. 75-HP. Sq. Cg. Motor, 220/440-V., 3-Ph., 60-Cy., 1200-RPM.

2—(NEW) G.E. 94 KW, 62½-VDC., Type CD generator, dir. con. 135-HP. Sq. Cg. Motor, 220/440 V., 3-Ph., 60-Cy., 1200-RPM., generator and motor B.B., splash-proof.

1—100 KW. Al. Chal. 125-VDC, generator, dir. con. 150-HP. syn. motor, 2300-V., 3-Ph., 60-Cy., 900-RPM.

1—200 KW. G.E. 250 VDC., 1200 RPM., dir. con. 300 HP. syn. motor, 2300/3/60 cy.

T. B. MAC CABE COMPANY

4312 CLARISSA STREET — PHILADELPHIA, PENNA.

REBUILT POWER EQUIPMENT—READY TO SHIP

M.G. SETS

250 V. D.C. Motors 220/440 or 2200 v. 3 ph. 60 cy.

No.	KW	Make	Speed
1	3	West.	1350
1	5	G.E.	1750
1	5	West.	1150
1	7½	West.	1150
1	10	West.	1750
1	12½	West.	1750
2	15	West.	1750
1	15	West.	1150
1	20	G.E.	1150
1	25	West.	1150
4	40	West.	900
1 new	50	Burke hi-frequency	3600
2	50	West.	900
4	75	G.E.	600
1	75	G.E.	1750
1	100	Star	1200
1	100	G.E.	1200
1	100	G.E.	515
1	125	Star	1200
3	150	Star	1200
1	200	G.E.	1200

Can furnish M.G. Sets at 125 V. D.C. from 5 kw. up to 100 kw. for immediate shipment from stock.

DYNAMOMETER

"Hi-Eff" hydraulic size 35#, model 588, 3100 rpm., Taylor Mfg. Co.

FREQUENCY CHANGERS

3—25 kw., 220/440 v. 3 ph. 180 cy., G.E. dir. con. to 25 HP, 1800 rpm., 220/440 v. 3 ph. 60 cy. motors.

COMPRESSORS

1—315 cu. ft. 100 lb. pres. Ingersoll-Rand, Models 315 and 315A portable Air Compressors with 105 HP Waukesha Oil Engines, complete with accessories.

10—240 CFM Westinghouse 150# pres. 3 cyl., vert., dir. con. 50 HP. A.C. Slip Ring Motors.

INDUCTION HEATING CONVERTER

New Van Norman, type indoor, floor, hi-freq. 32 kw. 220 v. 1 ph., 60 cy. 150 A. enclosed type.

FIRE PUMPS

3—1000 GPM Worthington Cent. 1 stage, 6½" suc. 5" dis. 150# pres. dir. con. 133 HP., 875/1750 rpm., 230 v. DC Motors and control. (Can furnish A.C. Motors if desired.)

SPECIAL* A.C. Motors 3 ph. 60 cy.

1—1400 HP., West. SYN 2300/4000/440/220 v. 1200 rpm.
1—500 HP. Elec. Machy. Syn. 4000/2200/440/220 V. 120 rpm.
1—125 HP, G.E. type K, 220/440 v. 440 rpm.
11—75 HP. Commonwealth 440 v. 1165 rpm., with Stearns Magnetic Brakes.
1—New 75 HP. West. type CS, 220/440 v. 3600 rpm.
60—New ½ HP., Diehl 220/440 v. 1725 rpm., tot. enc. BB.

GEAR HEAD MOTORS
SPLASH PROOF BALL BEARING

50 HP., G.E. 220/440 or 550 v. 3 ph. 60 cy. 1755 to 13 rpm.
50 HP., G.E. 220/440 3 ph. 60 cy. 1755 to 317 rpm.
50 HP., G.E. 220/440 3 ph. 60 cy. 1755 to 72 rpm.

WINCHES

240—Winch assembly portable engine hoists, swivel hook, 4¾" l. with 1½" opening and 30" of ¼" cabe. Hand cranked, double reduction gear with drum 5¾" w. can be used with A.C. or D.C. Motors.

25 Cycle MOTORS

2—300 HP. G.E. Slip Ring 2200 v. 3 ph. 375 rp. with control.

D.C. GENERATORS

6—250 KW West. 240 v. D.C. 1200 rpm.

A.C. GENERATORS 3 ph., 60 cy.

KW	Make	RPM	Voltage
450	Elec. Machy.	120	220/440/2300/4000

SLIP RING MOTORS, 3 ph., 60 cy.

2—600 HP. G.E. 2200 v., 900 rpm., MT.
2—500 HP. G.E. 2200 v. 900 rpm., MT.
2—400 HP. G.E. 2200 v., 900 rpm., MT.
1—250 HP. West. 220/440 v., 1800 rpm., CW.
1—150 HP. G.E. 220/440/550 1800 MT.
1— 75 HP. G.E. 220/440/550 600 I-M.

WELDING AND PLATING SETS

1—Chandeysson 50 KW., 40 V. D.C. 600 rpm., 75 HP. Synchronous Motor 220/440 v. 3 ph. 60 cy., with exciter 100% P.F.
1—Thompson Shell Welder including West. control, 6 electronic tubes, ½ HP. A.C. Motor.
1—Federal special seam welder 200 kva., 220/440 v. 60 cy. 5 DC max. sec. amps. 34000 at ¾ x 33 throat, sec. volts 5.1 10.2 max. air pres. 90 min. water inlet pres. 65# 70 deg. F. max.
1—Federal seam welder 150 kva., 220/440 v. 60 cy., .5 DC max. sec. amps. X30,000 at 4 BY-28 throat sec. volts 4-8 max. air pres. 90 deg. min. water inlet pres. 50 lbs. at 70 deg. F. 1 HP. AC Motor.

POWER PLANTS

5—NEW 1½ kw. Homelite portable 115 v. 1 ph. 60 cy. 1 cyl. air cooled 2 cycle gas or gasoline.
2—10 kw. 120/v. Star Generators dir. con. to Hercules DIESEL. 250.
1—25 kw. 120/208 v. 3 ph. 60 cy. 80% P.F. West. Gen. dir. con. to Le Roi Gasoline Engine.
2—30 kw. 125v. G.E. Generators dir. con. Buda DIESEL.
1—35 kva. Ridgway 220/3/60 dir. Con. Ridgway STEAM engine.
1—125 kva. West. 240/480 v. 3 ph. 60 cy. West. dir. con. Erie Ball STEAM Engine.
10—100 KW. Delco 240/120 v. D.C. 1200 rpm. dir. con. 150 HP Superior Diesel.

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ALL SIZES, VOLTAGE AND CYCLES

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TRANSFORMERS LARGE STOCK
D. C. GENERATORS ALL VOLTAGES
CONTROL EQUIPMENT

3 ph. 60 cy. A. C. Motors
3 ph. 25 cy. Motors
125 Volts D. C. Motors
230 Volt D. C. Motors
550 Volt D. C. Motors

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PUT ALL IDLE EQUIPMENT TO WORK. SEND YOUR LIST FOR PROMPT ACTION.

TURBO GENERATORS and BOILERS

1000 KW., 3 phase, 60 cycle, 480 volt, 3600 RPM., General Electric, rigid frame type non-condensing, 160 lbs. and 25 lbs. back pressure.

750 KW., 3 phase, 60 cycle, 2300 volt, 3600 RPM., Gen. Elec. rigid frame type, non-condensing 125 lbs. and 5-10 lbs. back pressure.

750 KW., General Electric rigid frame type 3600 RPM., 150 lbs. extraction 10 lbs. Generator can be wound for 220, 440, 550 or 2300 volts.

1—500 KW., 3 ph., 60 cy., 440 volt, 3600 RPM, Gen. Elec. to turbine #39937 nozzled for 185 lbs., condensing with Ingersol Rand Surface Condensor, etc.

6—400 HP steel encased water tube Heine boilers. Cross drum type.

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Power Plant Equipment Company

8403 Hegerman St. **Phila. 36, Pa.**

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100 KW **200 KW**

General Motors Diesel engines, 8 cyl., Model 8-268A, 6½" bore x 7" stroke, Direct conn. to: 200 KW WESTINGHOUSE ALTERNATORS, 3 phase, 50 and 60 cy., 400/440 V., including switchboards.

ALSO—COMPLETELY REBUILT

3 cylinder General Motors Diesel Engine Sets Direct Conn. to: 100 KW CENTURY ALTERNATORS, 3 phase, 60 cy., 440 Volt, Inc. switchboards.

1800 HP Fairbanks-Morse, Model 38D 8⅛, 8⅛"x10", 800 RPM, 10 cyl., air start, solid injection, new 1943. Engine weight: 33,000 lbs. Complete with all auxiliaries, Rebuilt.

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ELECTRIC MIXERS—PORTABLE & STATIONARY.

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1—250 KW GE turbo-generator unit, Steam conditions 525#, 350° superheat, condensing. Generator 3-phase, 60 cycle, 450-volts, 1200 RPM with 40 KW exciter.

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G. DeROSE
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Steam Engine with alternator direct connected 100 K.W. 220 volt 3 phase, 60 cycle.

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Motors, 3 Phase 60 cycle 220 Volt, 1140 and 1750 RPM. All sizes, ½ to 30 H.P. New and used.

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LARGE STOCK OF A.C. and D.C. MOTORS!

SLIP RING MOTORS—3 Ph., 60 Cy.

Qn.	H.P.	Speed	Volts	Make	Type
1	3	1750	440*	West.	CW-232C
1	5	580	220*	G.E.	HI-9
6	7½	810	550	G.E.	MTC-5201
1	7½	575	220*	G.E.	MT-522
2	10	1149	440*	West.	HF-7A
2	10	570	220*	G.E.	HI-11
3	11‡	810	550	G.E.	ITC-5003
2	15	570	220*	West.	CW-646
1	18	690	440*	West.	MW-316
1	20	860	440*	West.	CW-638
1	25	1130	550	G.E.	MT-323
2	25	850	220*	Wagner	BR
2	25	720	440*	Wagner	22VBR
1	30	865	440*	West.	CW-646
1	30	850	440*	G.E.	MT-332
1	30	675	440*	G.E.	MT-336
2	35	600	440*	F-M	HV-H16A
2	40	865	2200	Al.-Ch.	ARY-223C
1	40	560	440*	G.E.	MT-346
1	50	869	440*	West.	HF-12A
5	52‡	550	220*	G.E.	IQC-5013***
1	60	685	440*	West.	CW-758
1	60	570	550*	G.E.	MTC-5546
1	60	345	550	West.	CW
1	75	720	550	G.E.	MT-556
1	80‡	575	440*	G.E.	MTC-5352
2	125	430	440*	G.E.	IL-16
2	150	1750	440*	G.E.	MTP-549
1	150	900	440*	G.E.	M-6334Z
1	175	505	550	West.	CW-1002
2	200	600	550	G.E.	IM-17
1	200	495	2200	G.E.	IM-17A
2	250	580	2200	G.E.	IM-17A
3	250**	360	440	West.	CW-20-53-15
3	300	900	440*	G.E.	IM-17
1	300	514	550	G.E.	IM-17A
1	400	505	550	West.	CW
1	700	720	2300/4000		West. CW

* Can be furnished for either 220 or 440 volts but not both voltages.
‡ Intermittent rating. *** 2 phase.
** New.

SQUIRREL CAGE MOTORS—3 Ph., 60 Cy.

Qn.	HP.	Speed	Volts	Make	Type
4	1½	1140	440*	West.	CS-225-TEFC
10	3	1730	440*	G.E.	K-254-TEFC
4	7½	1740	440*	G.E.	K-284-TEFC
1	7½	1735	220*	G.E.	KF-284-EX-PF
1	7½	1150	220*	G.E.	FTR-952
1	10	1730	440*	G.E.	KF-324-TEFC
1	10	1140	440*	Wagner	CP2-326-TEFC
1	10**	880	220*	West.	CS-365-EX-PF
1	15	3485	220*	Reliance	AA-B3247
1	20**	3475	220*	West.	CS-326
2	20	1160	440*	West.	CS-554
4	25	1170	220*	L.A.	JX-405-TEFC
1	25	1140	2200	West.	CCL
1	25	900	220*	Howell	SCRB-356***
1	25	705	440*	West.	CS-W504-TEFC
1	30	1160	440*	West.	CS-644
1	30	870	220*	West.	CS-646
1	40**	3545	220*	G.E.	KF-4048
3	40	1750	440*	West.	CS-583-C
1	40	1200	440*	G.E.	KT-332
3	40	1175	220*	G.E.	K-445
2	40	900	2200	G.E.	FTR-536
1	40	1765	220*	West.	CS-444-TEFC
5	50	1160	220*	G.E.	K-504
1	50	850	220*	West.	CCL
2	60	900	440*	G.E.	KT-346
1	75	1750	2200	West.	CS-761
1	75	1160	440*	West.	CS-562-C
1	100	1765	2200	West.	CS-765A
1	100	870	440*	G.E.	KT-356
1	100	590	220*	West.	C
2	100	500	2200	West.	CS-930
1	100	495	2200	Al.-Ch.	AN
2	125	390	2200	G.E.	I-17-B
1	150	1780	440*	G.E.	K-547
3	150	1175	2300*	G.E.	KTP-557
2	200	1750	440*	West.	CS-5558
4	200	580	550‡	G.E.	KT-5668
4	350	1750	2300	G.E.	K-559
1	500	1200	440*	G.E.	KTP-567
1	700	1800	2300/4000	West.	CS-4-39D-12

* Can be furnished either 220 or 440 volts but not both voltages. ‡ Reconnectable for 440 volts.
** New. *** 2 phase.

230 VOLT CONSTANT SPEED D. C. MOTORS

Qn.	H.P.	Speed	Make	Type
22	2	850	West.	SK-20
20	3	1150	West.	SK-20
10	3	850	Reliance	T-23T
25	3½	850	West.	SK-30
3	7½	1750, 1310	West.	SK-43
2	7½	1150	G.E.	CDM-66
2	7½	875/1750	West.	SK-631
3	7½	850	G.E.	CD-75
5 (new)	10	1150	Al.-Ch.	EB-80
1	10	850	West.	SK-83
10 (new)	12½	600	We.t.	SK-93
5	15	825	West.	SK-90
2	20	1750/1310	West.	SK-83
2	20	1150	G.E.	RC-30
11	20	750	West.	SK-110L
17	25	825	West.	Sk-120
1	30	750	G.E.	RC
1	40	1700	West.	SK-103
1	40	750	G.E.	RC-34
1	50	650	G.E.	RC-16
2	60	1750/1310	West.	SK-143
3	75	850	West.	SK-160
1	150	700	Al.-Ch.	
2	200	1150	G.E.	RC-38
1	250	1150	C.W.	CMC-101A

230 VOLT ADJ. SPEED D. C. MOTORS

Qn.	H.P.	Speed	Make	Type
10	1½/2	560/200	G.E.	CD-55
1	2	225/900	Reliance	7ST
2	6	450/1800	G.E.	RF-9
6	5/7½	600/1800	G.E.	RA-30
1	12½	280/840	West.	SK-130
10 (new)	12½	600	West.	SK-93
1	15/20	500/1500	G.E.	CD-95
1	20/25	300/1200	West.	SK-153
1	23/29	300/1200	G.E.	RF-13
1	30	400/1200	West.	SK-163
1	35	500/1500	West.	SK-143
2	40/50	400/1600	Al.-Ch.	EB-147
1	75	500/1500	Cr.-Wh.	CCM
1	75	375/750	Cr.-Ch.	CMC-135H
3	100	225/900	G.E.	MPC-A
5	100	400/1200	Al.-Ch.	
1	100	320/960	West.	SK-200
1	175	230/750	West.	SK-230
2	375	350/500	G.E.	MPC

CRANE, MILL TYPE 230 V. D. C. MOTORS

Qn.	H.P.	Speed	Make	Type
2 (115 v.)	3½	700	G.E.	CO-1803
2	5½	760	West.	MCB-20
1 (new)	10	650	G.E.	MD-403-BE
1	20	515	West.	K-6
3	25	590	Diehl	TB
2	35	750	G.E.	CO-1828
3 (new)	35	600	West.	CK-9
1	50	750	G.E.	CO-1829A
1	50	600	West.	CK-9
5 (new)	50	525	G.E.	COM-1830AE
1	59	470	G.E.	CO-2007
2 (new)	60	550	G.E.	COM-1831AE
4	65	450	G.E.	COM-1830

VARIABLE VOLTAGE DRIVES

40 HP. Reliance, Variable Voltage Drives, each Consisting of:
1—40 KW. 250 Volt, Induction M-G Set, with two auxiliary 5 KW generators and exciter.
1—40 HP. 400/1500 RPM, Frame 383T, 230 Volt, DC Motor.
With full magnetic control providing jog forward, jog reverse, run, fast, slow, and stop, and motor operated field rheostat.

125 HP, 30/25 Cycle Motors

2—West. Type CS, Frame 871.52C, 125 HP, Cont 50°, 1750 RPM, 30 cycle, 1500 RPM, 25 cycle, 440 Volt, 3 Phase, Squirrel Cage Motors.

Above Items Represent a Partial Listing Only. Your Inquiries Will Receive Our Prompt Attention. All Equipment is Located In Our Cleveland Warehouse. We have Controls for Most Items Listed

ELECTRIC GENERATOR & MOTOR CO.

4521 HAMILTON AVE. CLEVELAND 14, OHIO

COMPLETE POWER PLANTS

STEAM—ELECTRIC—HYDRO—DIESEL

"Export Orders Carefully Executed"

As evidence of our ability to serve you well please note we have shipped on orders in the past 8 months 73 carloads of Power Plant Machinery, 29 of Cars going for Export Orders.

1—4000 KW Westinghouse Turbo-Generator Condensing. Excellent Condition
1400 2200 KW Turbo-Generator, non-condensing. Excellent Condition

2—35,000# Modern Boilers 200#
2—60,000# Boilers 250
4—1000 H.P. Heine Boilers 225#
2— 325 H.P. B & W Sterling Boilers 200#
2— 600 H.P. Edge Moor 200# Stokers
Smaller Boilers and Tire Tube Boilers also
2—3000 K.W. Turbos @ 350#

2—2500 K.W. G.E. Co., Turbo-Generator Condensing
2—2000 K.W. G.E. Co., Turbo-Generator Condensing
1—6500 K.W. G.E. Co., Turbo-Generator Condensing
1—2000 K.W. W.E., & M. Co., Turbo-Generator Con.
2—1000 K.W. G.E. Co., Turbo-Generator Condensing
2— 750 K.W. G.E. Co., Turbo-Generator Condensing
Several 500 KWs & Smaller Units

Non-Conducting Turbos—300—500—750—and 1,000 K. W. & Larger

CHARLES B. REARICK **30 CHURCH ST.** **NEW YORK**

Most all units still on foundation. Many may be seen operating

DIESEL UNITS

375 KVA Fairbanks Morse, 480 v.—Model 32E-14
250 KVA Fairbanks Morse 2300/440 v.—Style VA
225 KVA Westinghouse 2300/440/220 v.—Worthington
187 KVA Fairbanks Morse 2400/440/220 v.—Marine Type
156 KVA Ideal 240/480 v.—Buckeye
93.8 KVA Electric Machinery—Superior
75 KVA General Motors 440/220 v.

TURBO UNITS (NON-COND.)

37½ KVA Westinghouse 240/480 v.
125 KVA General Electric 240 v.
155 KVA (2) Allis Chalmers 220/440 v.—Terry
250 KVA General Electric 220/440 v.
250 KVA GE 600 v.—GE 30# BP
280 KVA General Electric 2300 v.—Terry
2500 KVA General Electric,480/240 v.

TURBO UNITS (COND.)

750 KVA GE; 2300 v. 250#
750 KVA General Electric 240/480 v.
940 KVA Westinghouse 6600 v.
1250 KVA General Electric, 2300 v.
1250 KVA Westinghouse 2300 v.
1250 KVA General Electric 600 v.
1250 KVA (2) Allis Chalmers 4000/2300 v.
1875 KVA (2) General Electric 2300 v.
2500 KVA General Electric 600 v.

BOILERS

250 HP Erie City 180#
254 HP (2) Sterling 200#
406 HP (2) Heine 180#
467 HP (3) Edgemoor 200#
469 HP (2) Sterling 425#
500 HP Murray 200#
507 HP Heine, bent tube, 400#
514 HP Erie City cross drum 200#
700 HP Sterling, 250#
1038 HP Springfield 200#

STEAM ENGINE SETS, A.C.

79 KVA Allis Chalmers 480/240 v.—Ames Unif.
187 KVA General Electric 240/480 v.—Chuse 4 v.
187 KVA Westinghouse 240/480 v.—Ames Unif. Ver.
375 KVA General Electric 2300/440 v.—Chuse 4 v.
450 KVA General Electric 2300/440 v.—Ames Unif.
500 KVA Crocker Wheeler 240/480 v. — Nordberg Unif.
625 KVA General Electric, 2300/440 v Skinner Unif.
750 KVA General Electric 2300/480 v.—Chuse Unif.
688 KVA Allis Chalmers 600 v.—Al Chal. Corliss

SYNCHRONOUS CONDENSER

750 KVA Wghse.; exciter; starting equipment

GAS ENGINE UNIT

375 KVA GE 3/60/480 v.—Cooper Bessemer

250 V. DIRECT CURRENT TURBO UNIT

750 KW Crocker Wheeler-DeLaval

POWER PLANT EQUIPMENT CO., INC. 39 Cortlandt St. New York, N. Y.

NEW SURFACE CONDENSERS

Built 1944-45—Never Installed

1—Allis Chalmers, 4440 Sq. Ft., 2-Pass ¾" OD #18 gage, Aluminum Brass Tubes.

1—Allis Chalmers, 7900 Sq. Ft., 2-Pass 3100—¾" OD #18 gage Aluminum Brass Tubes, 13 Ft. long.

WALTER H. WILMS & CO.
2526 GUARDIAN BLDG. DETROIT 26, MICHIGAN

BOILERS

2—404 H.P. Springfield, oil burners 170#
1—550 H.P. W.W. sectional header 200#
4—300 H.P. Casey-Hedges, oil, 165#
2—25,000# Stirling's, pulverizers, 425#
Other sizes and types
H. P. BREARLEY
3423-91st Street Jackson Heights, N. Y.

FOR SALE

Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.
PENN MACHINERY COMPANY
Jackson, Miss.

SYNCHRONOUS MOTORS

3/60/2200 Volts	3/60/440 Volts
2—50 HP, G.E., Type TS, .8PF, 600 RPM	1—60 HP, Type TS, .8PF, 1200 RPM
1—100 HP, Westinghouse, 1.PF, 1200 RPM	1—100 HP, Type TS, .8PF, 900 RPM
1—150 HP, G.E., Type ATI, 1.PF, 900 RPM	
1—500 HP, G.E., Type TS, .8PF, 720 RPM	1—750 HP, Type TS, .8PF, 900 RPM

All the above motors are equipped with starting equipment.

THE MOTOR POWER CO. OF NEW YORK, INC.
859 Madison Ave. RHinelander 4-6478 New York 21, N. Y.

APPLICATION ENGINEERS

45 KW M.G. Set 2200 AC 250 DC
100 KW M.G. Set 220/440 AC 125/250 DC
285 KW 240 volt Chuse Uniflow engine set
200 KW 480 volt Ridgway engine set
2500 KW 2300 volt G.E. Cond Turbine set
200 KW 1800 rpm 440 volt TEFC Motor
HOWARD B. JOHNSON & ASSOCIATES
53 W. Jackson Blvd. Chicago 4, Ill.

100 H.P. AMES ECONOMIC ASME 125 LB. PRES. BOILER 60 FT. STACK & GRATES

DARIEN CORP., 60 E. 42nd St., N. Y., N. Y.

WURTH for "WORTH"!

A. C. GENERATORS 3 PHASE—1 PHASE 15 to 62½ KVA
LARGEST STOCK OF A.C. AND D.C. MOTORS FROM 5 TO 200 H.P.
D.C. MOTOR GENERATOR SETS TO 75 KW • HIGH CYCLE GENERATORS
Send for Our Latest Stock List

WURTH ELECTRIC MOTOR COMPANY
Motors, Generators, Alternators, Frequency Changers.
141 GRAND ST. — CAnal 6-6138 — NEW YORK CITY

DIESEL GENERATOR UNIT

168 KW, 2300 V., 3 Phase, 60 Cycle General Electric, including switch panel; powered by 250 BHP, 257 RPM, Model B-4-60 Busch-Sulzer Diesel Engine. Excellent condition. Bargain.
M. KAPLAN & SON
MONROE, LA.

Electrical Equipment

We build SUB-STATION equipment to fit your requirements. Highest quality A. C. and D. C. Motors, Control Equipment and Transformers

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P. O. BOX 3227
TEL. 38-136
CHARLESTON, W. VA.
NEW and REBUILT

FOR SALE
GENERATOR

100 KW 720 r.p.m. Western Electric Generator, Price $1150. With direct connected Diesel Engine $2500.
CHURCHILL CONSTRUCTION COMPANY
1126 State Street, Lima, Ohio

PIPE FITTINGS

FOR SALE
2000 lbs. FORGED STEEL
ELBOWS - TEES - CROSSES - UNIONS
1¼" - 1½" - 2"
SCREWED - SOCKET WELD
FS-3503, Power
330 West 42nd Street, New York 18, N. Y.

MOTOR GENERATORS

500 KW G E. SYN. 600 V. 2200/4000 A.C. 1200 RPM. 3 PH. 60 CY. COMPLETE MANUAL SWITCHGEAR.

400 KW WEST SYN 600 V. 2200 A.C. 720 RPM. 3 PH. 60 CY. COMPLETE MANUAL SWITCHGEAR.

300 KW RIDGWAY SYN. 50 V. 2200 A.C. 1200 RPM. 3 PH. 6 0CY. COMPLETE MANUAL SWITCHGEAR.

200 KW RIDGWAY SYN. 250 V 2200 A.C. 900 RPM. 3 PH. 60 CY. COMPLETE MANUAL SWITCHGEAR.

Each unit listed above is owned by us and is available now for immediate purchase

WALLACE E. KIRK COMPANY
Incorporated
502 Grant Building, Pittsburgh, Pa.

Self-Contained Boilers

Two (2) 250 HP Kewanee Hor. return tube, built 1941, Natl. Board Stamped, 125 lbs. pressure, with or without Riley Stokers. Immediate Delivery.

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MODERN UNITS

750 HP Nordberg diesel 3 cyl. type 3EG. 625 KVA Westinghouse 3/60/2300 volt generator. Switchboard.

750 KW GE condensing turbine 3 stage 3600 rpm. 3/60/2300 volts. Surface condenser. New 1925.

25 KW International Ready Power portable diesel generator set. 1/60/220 volts. Radiator, etc. Like new.

MISSISSIPPI VALLEY EQUIPMENT CO.
507 Locust St. St. Louis, Mo.

AIR COMPRESSORS

2—175 CFM Inger.-Rand 2 cyl. vert. 150 P.S.I. Type XIV, dir. con. to G.E. 50 HP DC motor, 230 V. 400 RPM. Mounted on factory cast iron base. Complete with intercooler, unloader and access.

2—1500 CFM Penna. 110 P.S.I. horiz. 2 stage, Class DCE-2, with direct motor drive 300 HP Elec. Mach. syn. motor, 3 ph. 60 cy. 2300 V. 225 RPM, with intercooler and aftercooler and access. Request Bulletin D-100 for other compr. in stock.

PHILADELPHIA TRANSFORMER CO.
Box 566 Dalton, Pa.

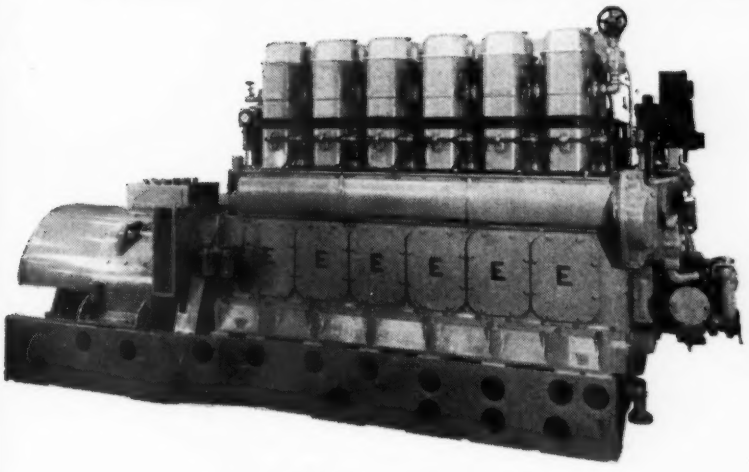
SPECIALLY PRICED

150 KW. Buckeye Diesel Plant consisting of 2—75 KW. AC units, 480 v. 514 RPM with all auxiliaries.

Also other units

STEPHEN A. DOUGLASS CO.
630 Fort Washington Ave.
New York 33, N. Y.

DIESEL GENERATORS



Delivery Today

COMPLETE GENERATOR POWER PLANTS

15—450 HP, Model DSG-6, 450 RPM, 12x15, 6 cylinder Diesel Engines direct connected to

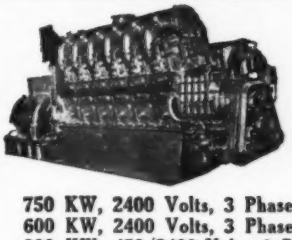
15—250 KW. Elliott Direct Current Generators, 120/240 volt, 3 wire compound wound, 450 RPM. Complete with all necessary auxiliaries.

Large supply of brand new spare parts available

HP	MODEL	KVA	RPM	NEW	HP	MODEL	KVA	RPM	NEW
8—1600	General Motors 16-278A	1200	720	95%	10—225	Buckeye Model 80	180	600	new
1— 450	Fairbanks Morse 32F	375	360	95%	1— 180	Fairbanks Morse YVA	150	257	95%
1— 375	McIntosh Seymour	350	360	85%	3— 150	Worthington BB	125	600	99%
1— 365	Ingersoll Rand S	340	600	95%	2— 150	Buckeye Model E	145	400	95%
4— 360	Fairbanks Morse YVA	300	257	80%	1— 90	Cummins HIS 600	62.5	1200	new
5— 350	General Motors 8-268A	250	1200	95%	1— 80	Fairbanks Morse YVA	65	300	85%
1— 300	Buckeye Model E	250	400	90%	1— 75	Buckeye Model J	62.5	600	95%
2— 240	Fairbanks Morse YVA	200	257	85%	1— 40	Buckeye Model J	30	600	95%

Many other important Diesel offerings from 15 KW to 1000 KW

Diesel Motors
WE HELP TO LIGHT AND POWER THE WORLD
PORT WASHINGTON, L. I., N. Y. **CORPORATION** TEL: PORT WASHINGTON, 2000



DIESEL Generator Plants For Immediate Delivery

HEMCO

750 KW, 2400 Volts, 3 Phase, 60 Cycle, 720 RPM, General Motors Model 12-567
600 KW, 2400 Volts, 3 Phase, 50 Cycle, 600 RPM, General Motors Model 12-567
300 KW, 450/2400 Volts, 3 Phase, 60 Cycle, 1200 RPM, General Motors Model 8-268A
200 KW, 450/2400 Volts, 3 Phase, 60 Cycle, 1200 RPM, General Motors Model 8-268A
125 KW, 220/440/2400 V, 3 Ph, 60 Cy, 1200 RPM, General Motors Model 3-268A
125 to 900 HP Diesel Driven Right Angle Pump Drive Units 900 to 1800 RPM.
125 KW, 220/440/2400 Volts, 3 Phase, 60 Cycle, 1200 RPM, Superior Diesel Model GDB-8
75 KW, 220/440 Volts, 3 Phase, 60 Cycle, 1200 RPM, Hercules Diesel DFXE
50 KW, 440 Volts, 3 Phase, 60 Cycle, 900 RPM, Fairbanks-Morse Model 36A 5½
100 KW, 3 Wire, 125/250 Volts DC, 1200 RPM, General Motors Model 3-268A
900 HP, General Motors Model 12-567, Propulsion Unit Complete

HERCULES ELECTRIC MACHINERY and EQUIPMENT CO.
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Cable Address HEMCOY Los Angeles 6, Calif.

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DIESEL ENGINES

BOILERS

MOTORS
TRANSFORMERS

For Immediate Shipment

1—500 HP B&W STIRLING. NEW 1941—CHAIN GRATE STOKER.
1—30,000 #/hr B&W INTEGRAL FURNACE. 425 PSI. NEW 1941. PULVERIZER.
1—650 HP CASEY HEDGES. 225 PSI. NEW 1932. BARGAIN.
1—250 HP CASEY HEDGES. 200 PSI. OIL FIRED. COMPLETE.
1—216 HP VOGT ML-L4. 160 PSI. NEW 1930, STOKER.
1—200 HP LEFFEL SCOTCH MARINE BOILER, NEW 1942, 150 PSI.

Other Boilers Also Available

SEE *Fletcher* FIRST!

FLETCHER SALES CO.

325 Fincastle Building — LOUISVILLE, KY.

MOTOR GENERATOR SETS

New 1942-1944

1000 KW, 550 Volts DC, *ALLIS CHALMERS*, 720 RPM, motor synchronous, 2300 Volts, 3 phase, 60 cycle (6 units)
600 KW, 500 Volts DC, *ELLIOTT*, 720 RPM, motor synchronous, 2300 volts, 3 phase, 60 cycle (4 Units)
500 KW 600 Volts DC, WESTINGHOUSE, 900 RPM, Motor Synchronous, 2300 volts, 3 phase, 60 cycle, (7 units)
300 KW, 125/250 Volts DC, *WESTINGHOUSE*, 1200 RPM, Generators only. Will supply suitable motors (4 Units)
100 KW, *ELECTRIC PRODUCTS CO.* AC Generator, 3 phase, 60 cycle, 440 Volts, 1200 RPM. Motor—*RELIANCE* 150 HP, 230 Volts DC, Complete switchgear (2 Units)

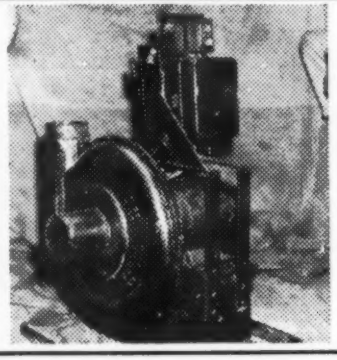
Immediately available.

A. G. SCHOONMAKER COMPANY, INC.
50 CHURCH STREET, NEW YORK
Established 1898 — Digby 9-4350

1—Westinghouse Vertical Generator 375 KVA-240 RPM—80 P.F.—2300 Volts—3 Phase—60 Cycle—with direct connected 125 Volt Exciter. Excellent condition. Also Gears, Couplings, Thrust Bearings Etc. Also Waterwheel complete.
1—Woodward Oil Water Wheel Governor type H-R Size 5x9 2500 ft. lbs. #4147. Excellent condition.
3—G.E. Transformers 1 Phase—Form KD—Type H—Circular Coil Design—60 Cycle—500 KVA—55°c rise—33000-2200/11000—oil filtered tests—30 KV now in operation.
3—G.E. Type H—form D.D.I.P.—Single Phase—60 cycle—300 KVA—33000/29700 to 2300/4000 Y. Recently reconditioned by G.E. New Leads filtered oil and cleaned cores.
1—Orr & Samboiler Oil Burner, Reading, Pennsylvania Serial #KMOA ¼ to 1/3 HP required 29# 1 gal. per hour Temperature Controller—No. Serial #451498 Water Heater Minneapolis & Honeywell control Stack control & Thermostat.
1—Westinghouse geared speed changer, ratio 3 to 1, 175 HP Type SVR-13.
1—Westinghouse geared speed changer, ratio 1 to 1, 175 HP Type SVR-13.
1—4000# capacity motor driven freight elevator with automatic stop control.
1—Garrick Combustion controls for two boilers to be sold as unit.
1—#4 Reeves Drive open.
1—#5 Reeves Drive open
1—Shepard Elevator, Motor driven 1 HP, 1 ton capacity.
1—750 GPM Underwriter's fire pump, steam driven (complete).
1—Ton Elevator motor driven ½ HP.
Vacuum Pumps, Plunger Pumps, suction pumps and all kinds of pumps.
1—Unity Power Factor G.E. Synchronous Motor Type ATI, Form S, 514 RPM, 250 H.P., 4000/2300 volt. Complete with starter & motor generator exciter.

A visit to the mill would prove profitable as we have many items for sale too numerous to mention. Our plant is located at Walloomsac, New York

WALLOOMSAC PAPER MILLS, INC.
Mills: Walloomsac, New York
Main Office: 25 Vanderbilt Avenue
New York 17, N. Y.



BARGAINS IN BLOWERS

Centrifugal Hi-Pressure Blower, single stage, closed type impeller, 1000 CFM at static pressure of 11.2" water at 70° F. Mfg. by Buffalo Forge Co., Complete with G. E. Motor, 5 h. p., 3450 RPM, 60 cycle, 3 phase, 221/400 volt, AC current, magneto starter and push button station. Exhaust outlet adjustable to any angle. Used, guaranteed excellent condition. 150 for immediate delivery at

$112.50 EA.

LIBERAL DISCOUNT ALLOWED ON QUANTITY ORDERS AND TO DEALERS

Cincinnati Sales Company
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DUnbar 6220

FOR SALE

DETROIT ROTO STOKER

1 New, unused stoker. Designed for 600 HP B & W boiler. Guaranteed 200% rating. Three 27" rotors, 13 x 9', stationary grates, complete for installation. Purchasing power reason for selling.

GOODMAN LUMBER CO.
Goodman, Wisconsin

GENERATOR

FOR SALE

600 K.W. Allis-Chalmers .8 PF 440/3/60 Generator direct connected to 120 RPM Allis-Chalmers Cross Compound Steam Engine designed for 115 P. S. I. G. (H.P. cylinder can be sleeved at nominal cost with factory recommendation to operate at 175#), 450°F. max. temp., including generator panel also 440/360 M.G. Exciter.

Location: Near Honolulu, Hawaii.

Offered by original purchaser. Condition excellent—has seen little use; very reasonably priced for quick sale.

Write Alexander & Baldwin, Ltd.
Box 3440, Honolulu 1, Hawaii

$$$$ **FOR SALE** $$$$

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(3) Perfect Spread 24" stokers, grates, motors and parts, can be seen in operation in 600 H.P. Sterling Boiler available in (30) to (60) days. $800.00 each F.O.B. Indianapolis, Ind.

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(NEMA Frame)

220 440 volts, 3 ph., 60 cycle

Qu	HP	RPM	Make	Type
10	1	1800	A.C.	BB. DP—New
7	1	1800	L.A.	TEXP New
10	2	1800	Al. Ch.	BB. DP—New
10	3	1200	Al. Ch.	OBB
10	3	1200	Al. Ch.	XP Cl.1 Gp.D New
35	3	1800	Al. Ch.	BB. DP—New
10	5	1200	Al. Ch.	OBB
30	5	1800	A-C.	BB. DP—New
2	7½	1200	Al. Ch.	OBB
1	7½	1200	C-W	TEXP
10	7½	1800	L. Allis	OGX—New
2	10	530	Wagner	HS-HT—R&G
1	10	900	G.E.	SB-DP—New
1	10	1750	Al. Ch.	TEFC
1	10	1800	Al. Ch.	OBB—New
1	10	1800	Al. Ch.	TEFC—New
1	10	1800	Al. Ch.	OBB—New
2	10	3600	Al. Ch.	OBB—New
2	10	3600	G.E.	BB. DP—R&G
3	15	1200	G.E.	BB. DP—New
1	15	1200	G.E.	HT—New
1	15	3600	G.E.	SB. DP—New
3	20	1200	Al. Ch.	OBB—New
1	20	1750	Al. Ch.	550v.—OBB
1	50	1200	Al. Ch.	OBB—New
2	50	1200	Al. Ch.	OBB—New
1	50	1800	Al. Ch.	OBB—New
1	125	1800	Al. Ch.	OSB—New

D. C. MOTORS, 230 VOLTS ADJUSTABLE SPEED, RECONDITIONED AND GUARANTEED
(Except New Where Shown)

Qu	HP	RPM	Make	Type
3	3/5	1150/2825	Reliance	14-T
2	3½/5½	500/1500	Wstg.	SK-90
1	3/5	600/1800	Wstg.	SK-50
1	3/5	300/900	Elec. Dyn.	Frame 5-S
1	5/7½	500/2000	L. A.	Frame 851
1	7½/10	250/1000	Wstg.	SK-91
1	7½/10	600/1800	Wstg.	SK-63A
2	10/15	300/1200	G.E.	RLC-201
2	10/15	500/1500	Reliance	78-TF
3	10/15	400/1200	G.E.	CD-95
3	10/15	575/2300	G.E.	CD-85
3	10/15	400/1350	Marble-Card	Shunt
1	15/20	400/1600	C-W	TEFC
1	15/20	400/1600	Reliance	115-V.
2	15/20	500/1800	G.E.	RF-11
1	15/20	550/1650	G.E.	CD-103
5	20/25	400/1200	G.E.	CD113, RF13
7	20/25	600/2000	G.E.	CD-105
3	40/50	250/1500	G.E.	CD-1441
1	40/50	350/1050	Wstg.	SK-141
1	50/60	300/900	Elec. Dyn.	30-S

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ANSWERS
to questions on page 272

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(2)	2000	23000	2300	1
	1500	2200	600	3
	1000	2200	220	3
(3)	667	2300	600	1
	600	440	220	3
	540	680	82	3
(3)	500	13800	480	1
(3)	500	2300	230/460	1
(3)	500	6600	575	1
(3)	333	1000	2300	1
(3)	333	2400	480/240	1
(3)	300	2400	240	1
(3)	300	2400	120/240	1
(3)	300	2400	120/240	1
	250	480	120/240	1
(50)	250	2400	220/440	1
	250	7200	240/480	1
	250	460	178	1
(3)	200	13800	240/480	1
(2)	200	12000	600	1
(3)	200	4150	480	1
(3)	200	4000	480/240	1
	200	4000	115/230	1
(3)	200	2400	240/480	1
	200	550	440	1
	200	550	120/240	1
(2)	180	13200	125/220	1
(3)	150	2200	550	1
(3)	165	2400	240/480	1
(7)	150	2400	110/220	1
(3)	150	2400	220/440	1
(3)	150	33000	2300	1
(3)	150	2300	550	1
(3)	150	2300	230/460	1
	125	440	110/220	1
(2)	125	440	220	2/3
(4)	100	33000	2400	1
(3)	100	2200	550	1
(6)	100	2400	230/460	1
(2)	100	2400	660	1
(3)	100	2400	115/230	1
(3)	100	2400	115/230	1
	100	4000	115/230	1
(2)	100	440	115/230	1
(6)	75	220	110	1
(3)	75	2300	115/230	1
(5)	50	460	115/230	1
(37)	50	2400	115/230	1
(3)	50	440	115/230	1

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2—254 H.P. B&W. Type H all accessories
1—617 H.P. Vogh. Never used
1—Corliss Engine, 400 horsepower connected to G.E. generator, 300 K.W. 2300 volts, speed 180, 3 phase, 60 cycle.
1—Corliss Engine, speed 225, 200 H.P., connected to G.E. generator, 2300 volts, 3 phase, 60 cycle, 150 K.W.
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With Stearns 440V Brake
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NEW
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Electric Light Department
Borough of Schuylkill Haven, Penna.

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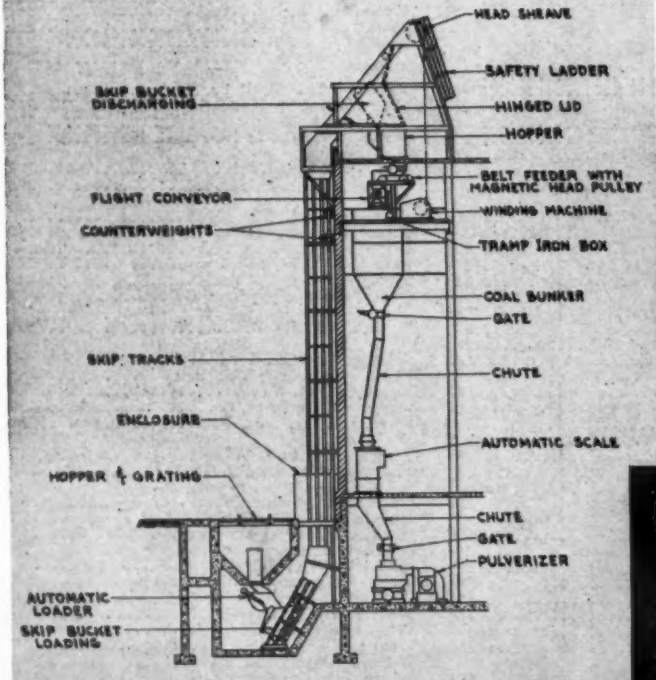
FAIRFIELD
coal handling system

Above—Illustrating skip hoist on outside wall of power plant.

Right—Shows skip hoist superstructure on roof of power plant.



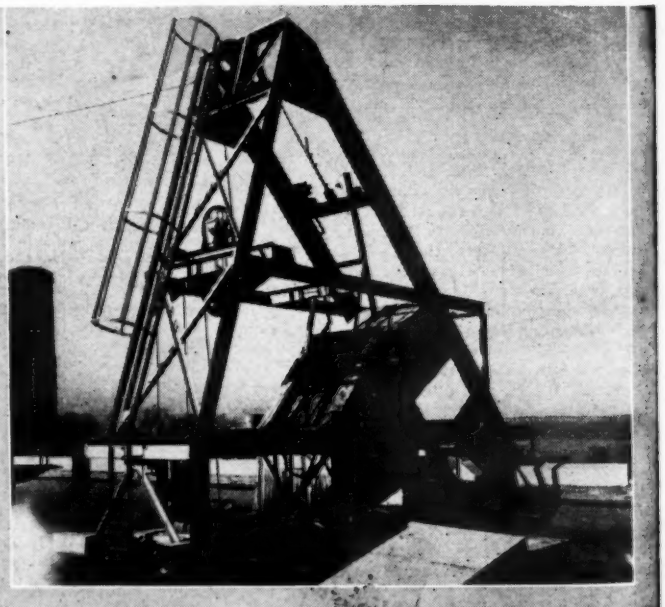
One of the most efficient and dependable methods of handling coal is the Fairfield skip hoist.

Shown is a 60 cu. ft. skip hoist with a 91 ft. lift, elevating the coal to hoppered bottom coal bunkers inside the plant. The system has a capacity of 50 tons per hour.

At the skip discharge the coal is passed over a magnetic belt feeder which removes tramp iron. The coal is then distributed to the bunkers by a double strand roller flight conveyor. It is then weighed as used and delivered to the pulverizers.

This installation was designed—built—erected by Fairfield to meet the specific needs of this plant.

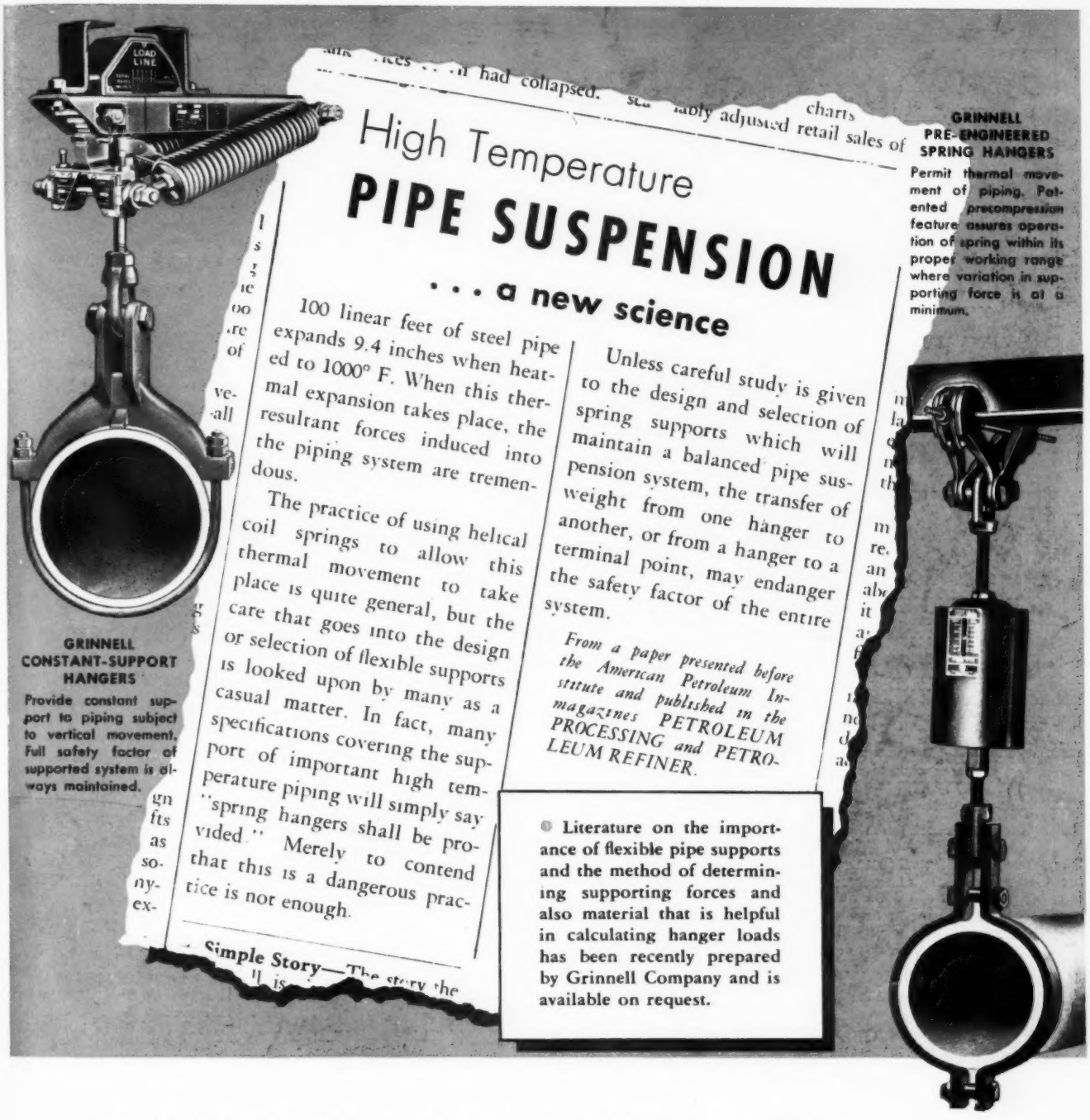
Fairfield Engineers will gladly do the same kind of a job for you. Why not write us for complete details today.



THE FAIRFIELD ENGINEERING CO.

Builders of Coal and Ash Handling Equipment

320 CHICAGO AVENUE · · MARION, OHIO



had collapsed. charts ably adjusted retail sales of

High Temperature PIPE SUSPENSION ... a new science

100 linear feet of steel pipe expands 9.4 inches when heated to 1000° F. When this thermal expansion takes place, the resultant forces induced into the piping system are tremendous.

The practice of using helical coil springs to allow this thermal movement to take place is quite general, but the care that goes into the design or selection of flexible supports is looked upon by many as a casual matter. In fact, many specifications covering the support of important high temperature piping will simply say "spring hangers shall be provided." Merely to contend that this is a dangerous practice is not enough.

Unless careful study is given to the design and selection of spring supports which will maintain a balanced pipe suspension system, the transfer of weight from one hanger to another, or from a hanger to a terminal point, may endanger the safety factor of the entire system.

From a paper presented before the American Petroleum Institute and published in the magazines PETROLEUM PROCESSING and PETROLEUM REFINER.

Simple Story—The story the

GRINNELL CONSTANT-SUPPORT HANGERS
Provide constant support to piping subject to vertical movement. Full safety factor of supported system is always maintained.

GRINNELL PRE-ENGINEERED SPRING HANGERS
Permit thermal movement of piping. Patented precompression feature assures operation of spring within its proper working range where variation in supporting force is at a minimum.

● Literature on the importance of flexible pipe supports and the method of determining supporting forces and also material that is helpful in calculating hanger loads has been recently prepared by Grinnell Company and is available on request.

GRINNELL OFFERS A COMPLETE PIPING SERVICE

PIPING SUPPLIES

- Pipe, Valves and Fittings
- Engineered Pipe Hangers
- Grinnell-Saunders Diaphragm Valves
- Thermolier Unit Heaters
- Prefabricated Piping
- Plumbing and Heating Specialties
- Oil, Water Works and Industrial Piping Supplies

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Automatic Sprinklers and Special Hazard Fire Protection Systems

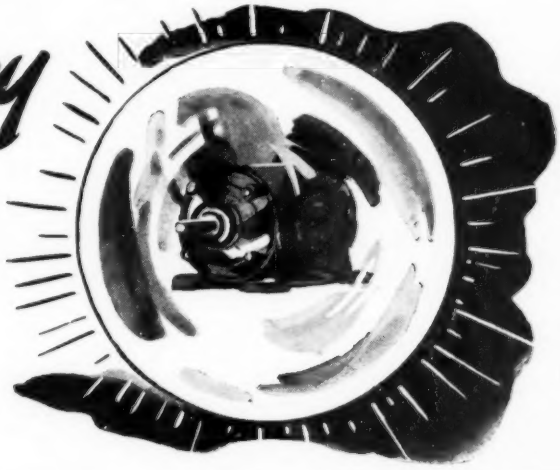
AMCO Humidification and Cooling Systems

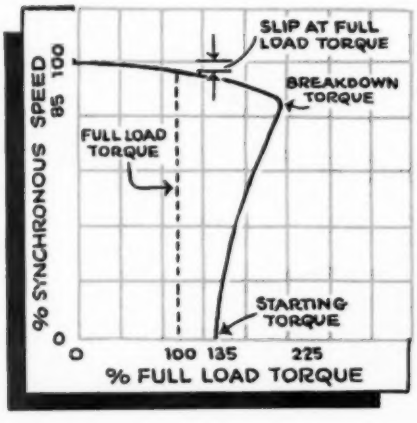
GRINNELL COMPANY, INC.
Executive Offices
PROVIDENCE 1, RHODE ISLAND

GRINNELL

WHENEVER **PIPING** IS INVOLVED

Here's One Way to Choose Motors...





Sure, Your Local "Swami" can pick a motor for you in an instant! But if you want motor counsel you can *bank* on . . . you'll consult a reputable motor manufacturer. In place of crystal-ball gazing, he'll advise you to follow *practical* and *orderly* steps in arriving at *right* motor selection. For example . . .

First, Study Your Power Supply . . . voltage, frequency, number of phases; the p.f. required by your utility. Judicious selection will help balance your motor capacity . . . lower power costs. And check the voltage regulation — choose motors with enough torque to start and carry the load. Next . . .

Study the Driven Machine and surroundings. What hp? What starting torque? Will you need a horizontal or vertical motor — direct-connected, belt-driven or gear-operated? How about surroundings — ambient temperature, moisture, corrosion, dust. Each calls for a particular type of protection. Now . . .

Study Your Motor Characteristics. *A-c motors?* For most jobs they're satisfactory and economical. *D-c motors?* For wide speed range; for fast acceleration or reversal they may prove your best bet. *Synchronous motors?* When applicable they give you low-cost p.f. correction. You're *still* undecided? Call in your nearby Allis-Chalmers motor expert. He'll be glad to help you decide—with recommendations backed by 50 years of motor-building!

Wise Motor Choice Saves Power; Ups Profit!

YES, CRYSTAL-BALL GAZING methods are out when you're trying to get *maximum* return on your electric motor investment. Slip-shod selection usually results in over-capacity, high power and maintenance bills — the kind of costs that in the competitive era of tomorrow you won't be able to afford!

That's why it pays to know more about *all* types of motors . . . their operation . . . limitations . . . maintenance. And there, too, is where your Allis-Chalmers motor expert can be of real help! ALLIS-CHALMERS, MILWAUKEE.

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A CENTURY OF SERVICE to Industry THAT MADE America Great

ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment-
Biggest of All in Range of Industrial Products